OCTOBER 1, 1942

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OCTOBER 1, 1942
VOL. 150, NO. 14

This Week in . . .

THE IRON AGE

Twenty-Fourth Metal Congress Preview Issue

Editorial

Technical Articles

Features

News and Markets

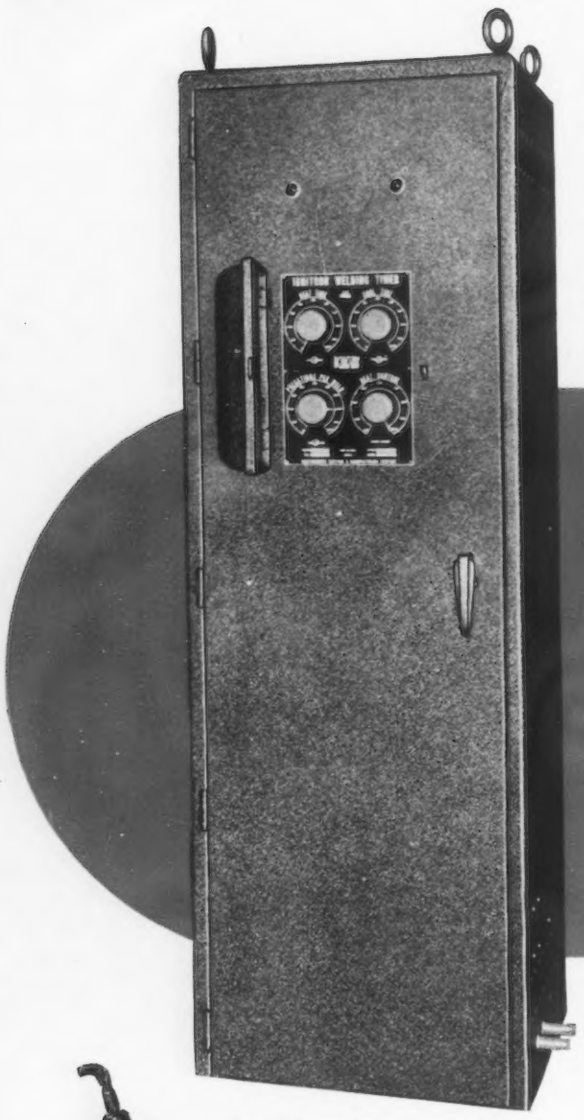
Metal Congress Preview

Special Advertising Sections

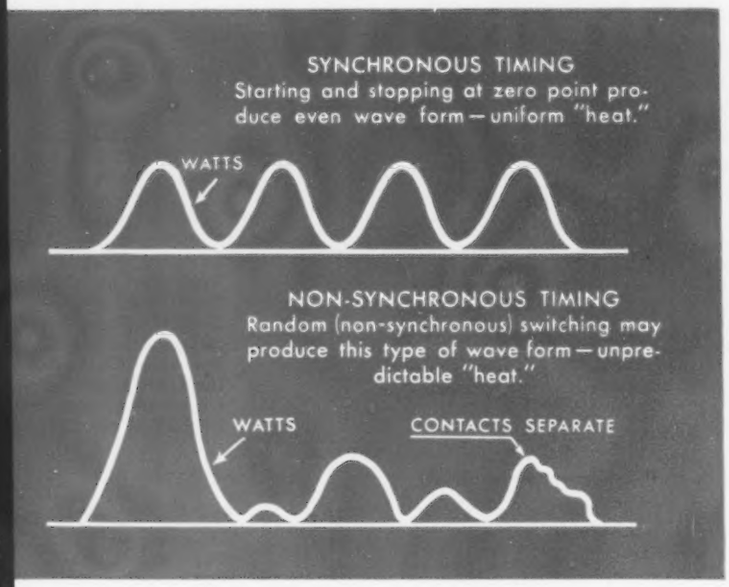
Reduce Rejects

on short-time welds...with Westinghouse

SYNCHRONOUS TIMERS



Type SX, combination timer, fully electronic. For spot, seam or pulsation welding. Where frequent changes of timing are necessary.



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The Westinghouse development of the Ignitron tube has made it possible to make and break circuits noiselessly with split-second accuracy as many as 600 times a minute without any moving parts.

Where thin pieces or metals with critical fusion points are to be welded, random (nonsynchronous) switching is responsible for a high rate of rejects. Unpredictable transients mean unpredictable heat—burn through, warping, and even cold welds.

Westinghouse Synchronous Timers eliminate these transients—they start and stop current always on the zero point of the current wave, or later (when heat control is used). As a result, each weld is a duplicate of the preceding one because its wave form is the same.

With these Westinghouse Timers, you can mass-produce short-time welds of uniform strength and soundness. Metallurgical characteristics can be controlled (stainless steel will not lose its stainless properties) and appearance is improved by holding indentation to a minimum.

There's a Westinghouse Control that will fit your present requirements, whether it's production seam welding only, or a combination of spot, pulsation, and seam welding. Ask your Westinghouse representative for the facts about this precision electronic control. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

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RESISTANCE WELDING CONTROL

THE IRON AGE

OCT. 1, 1942

ESTABLISHED 1855

Not Too Little, Nor Too Late

FOR the past 10 years, American industry has had the unique distinction of being in three places at once, continuously and simultaneously. It has been in the frying pan, back of the eight ball and in the doghouse. That's a record.

It had been maligned, mauled, mishandled and mayhemed by politicians, reformers, labor leaders, left-wingers and mud slingers until the average employer felt like an outcast of society and was tempted to wear a CIO button to show that his parents were married.

Thank goodness, the doghouse days of the industrialist are nearing an end. The cranks and crackpots can't keep him there much longer.

Industry is emerging from the doghouse strictly on a performance basis and with an Army-Navy "E" draped around its neck for good conduct.

Army-Navy "E"s, like Maritime Commission Awards are given only to those concerns that have beaten their schedules. To concerns who have done more than Uncle Sam expected of them when he put the heavy loads on their shoulders.

For the past six weeks an average of more than 50 such awards per week have been made to American industrial concerns. During one recent week there were over 100; last week over 60. America can rightly be proud of the quality of both management and labor which has so ably delivered the goods.

But management and labor could not have done it without materials.

And this brings into the picture the metallurgists of America.

This war is essentially a war of metals. Not merely a war of iron and steel but of a myriad other metals which are called for in the almost infinite inventory of Mars.

Mars is no respecter of persons, but he has a high regard for metallurgists. I think that he and his associates will be hovering over the Auditorium in Cleveland next week, to find out what you gentlemen of the American Society for Metals, American Welding Society, American Institute of Mining and Metallurgical Engineers, and Wire Association have done to provide America with the sinews of war.

And I think that Mars will be astonished at what he sees. And perhaps, a little later, more astonished at what he has not seen.

For thanks to our metallurgists of America, this country is now in a position to say: "not too little nor too late, but enough and in time."

J. H. Van Deventer

Inland loaders cheer as plates for Liberty ships are placed, still hot, into a steel gondola.

Inland Men and Mills Set New War Production Records

New production records are short lived at the Inland mills—where thousands of skilled workers never cease striving to produce more steel for America's great war plants and ship yards.

Some of the latest records are—an all-time monthly high by the blast furnace department; a new record by plant No. 2 open hearth furnaces, made despite handicaps of scrap quality and supply; enough plates for two Liberty ship hulls rolled in one 24-hour turn on the 76-in. continuous mill; a new all-time plate record on the 100-in. mill; a new ship channel peak on the 28-in. mill; four records in two months on the 14-in. merchant bar mill; record output by the 24-in. bar and plate mill, Inland's oldest mill which made records in World War 1; and, a new record for all Inland plate mills—enough plates in one month for 34 Liberty ships!

Not to be outdone by the mills, every ship of the Inland fleet has broken its all-time cargo-carrying record. The L. E. Block, flagship of the fleet, recently bettered its record for the seventh time this season, by delivering a cargo of 16,369 tons of iron ore to the Inland mill docks.

These records are the answers of Inland men to America's call for more plates and channels for ships, more bars for guns, more billets for shells—more steel to back the efforts of our fighting men.

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High Manganese Austenitic Steels

By RUSSELL FRANKS, W. O. BINDER, and CHARLES M. BROWN

Union Carbide & Carbon Research Laboratories, Inc., Niagara Falls

THE trend in structural design during recent years has been to take advantage of high strength materials in order to obtain a decrease in the weight of the finished structure without sacrifice of strength. Steels of high strength have been developed so as to save unnecessary weight in mobile structures, such as airplanes, high speed trains, trucks and truck bodies. The upward trend in using high strength steels has been particularly marked in aircraft, in which a reduction in weight contributes greater load carrying capacity, greater speed and increased distance over which airplanes can travel. The highest strength steels developed so far for this purpose have been the cold-rolled austenitic 18 per cent chromium—8 per cent nickel, and 17 per cent chromium—7 per cent nickel types of steels. It is possible to develop in these cold-rolled stainless steels a minimum tensile strength of 185,000 lb. per sq. in., a minimum yield strength (0.2 per cent offset) of 140,000 lb. per sq. in., and an elongation of at least 8 per cent in 2 in. Similar properties are developed in compression, particularly after application of the low temperature heat treatment at about 200 deg. C. (392 deg. F)[1 2 3]

Cold-rolled stainless steels of these types have been used successfully as structural members for aircraft, and in building high speed trains as well as other lightweight, high-strength structures. Thin sections of the steels can be used without the necessity of protecting their surfaces against atmospheric deterioration, which represents a valuable asset. The excellent spot welding characteristics of the cold-rolled stainless steels has further added to their value for lightweight, high-strength structures, as these eliminate to a large extent the necessity for using riveted structures. The high modulus of elasticity of the steels, which is an important property of steels in general, has made them an ideal material for structural members of lightweight high-strength structures.

. . . This new type of steel has extremely promising possibilities for aircraft construction and for other light-weight structures. The preliminary physical data, shown for the first time herein, indicate that the cold-rolled manganese and manganese-chromium steels are amenable to forming, drilling, machining, etc., are easily welded, and have strengths equal to the best of stainless steels with no serious loss in ductility.

An investigation has resulted in the development of a series of steels that have mechanical properties similar to those of the stainless steels even though certain of the new steels are not as resistant to corrosion. It was thought that in many applications this would be no serious handicap as the surfaces can be adequately protected against deterioration under atmospheric conditions. It has been found that when certain percentages of manganese are added to steel of relatively low carbon content, an austenitic steel is obtained which has high strength after cold rolling, both in tension and in compression. Inasmuch as these high manganese steels are austenitic in character, it is necessary to cold roll them to obtain high strengths rather than to apply a heat treatment such as is required for raising the strength of ordinary steels. Investigation of these manganese steels has brought to light, as will be shown in the discussion, three series of materials that will develop basically the same high strength on cold rolling as the austenitic stainless steels ordinarily used for structural purposes but which vary widely in regard to their resistance to corrosion.

The first series consists of the

16 per cent manganese steels containing small addition of nickel (up to 2 per cent) or copper (up to 1 per cent) or both, which will rust under atmospheric conditions, whereas the second consists of steels of similar manganese nickel and copper contents and about 3 per cent chromium, which greatly retards progressive rusting under normal atmospheric conditions. The third series consists of 16 per cent manganese steels containing about 12 per cent chromium, which is sufficient to impart a high degree of resistance to staining inasmuch as all the chromium is in solid solution in the austenite.

In the development work on these steels, it was found that the addition of manganese alone to ordinary low-carbon steel was insufficient to produce metal with the desired properties in regard to cold rolling. The steels required were those that would not increase in hardness too rapidly or too slowly on cold rolling, but at a moderate rate to give high strength with satisfactory ductility. It was learned that if the manganese content was kept between 15 per cent and about 18 per cent, with a carbon content not greatly exceeding 0.35 per cent, the steels could be more readily cold rolled than if the manganese content were lower and the carbon content higher. As previously stated, additions of small percentages of nickel and copper were made to produce a sufficiently stable austenitic steel of high-manganese content, with the result that the metal could be cold-rolled sufficiently to give the necessary strength and good ductility.

The different types of 16 per cent manganese steels were hot

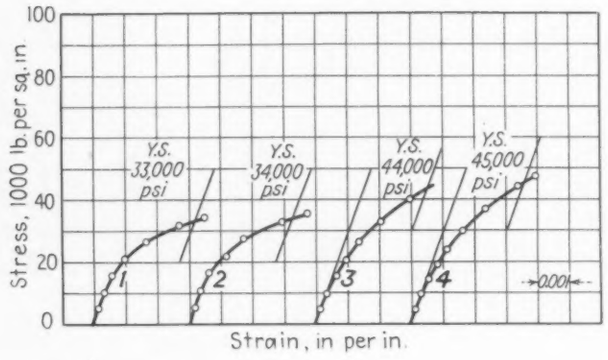
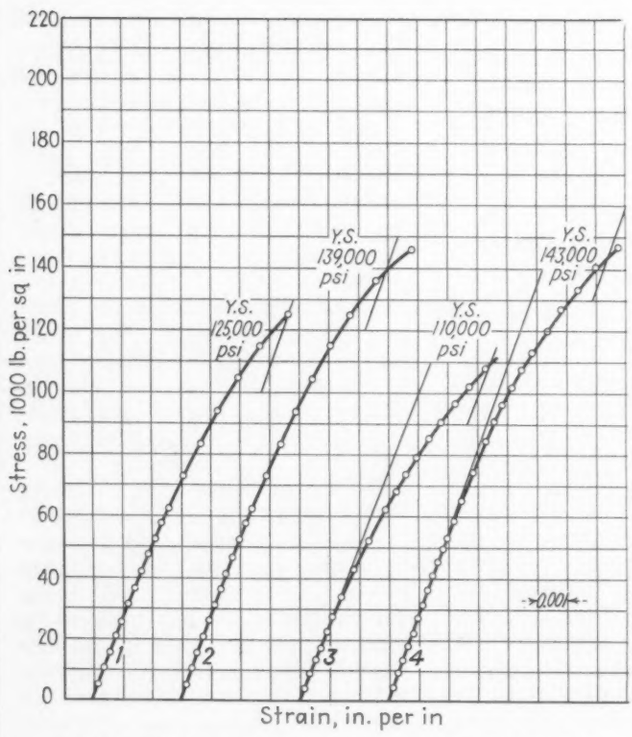


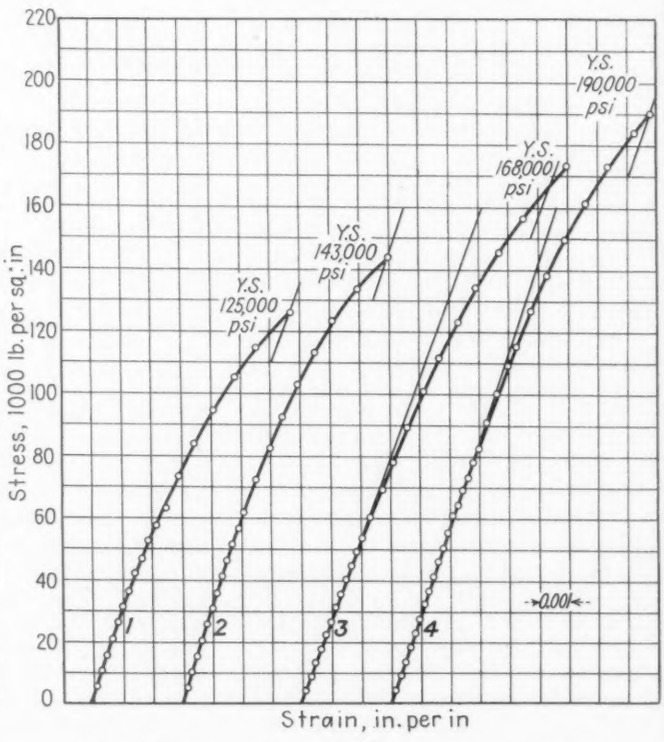
Fig. 1—Stress-strain curves for steel H-641 containing 16.30 per cent manganese, 1.14 nickel, 1.11 copper, 0.27 silicon, and 0.10 per cent carbon.

LEFT

Reduced 0 per cent by cold rolling; heat treated at 1000 deg. C. Curve 1 = longitudinal to direction of rolling, tension; curve 2 = transverse to direction of rolling, tension; curve 3 = longitudinal to direction of rolling, compression; curve 4 = transverse to direction of rolling, compression.



Reduced 35 per cent by cold rolling, longitudinal direction.



Reduced 35 per cent by cold rolling, transverse direction.

Curve 1 = As cold-rolled, tension; curve 2 = cold-rolled and heat-treated at 200 deg. C., tension; curve 3 = as cold-rolled, compression; curve 4 = cold-rolled and heat-treated at 200 deg. C., compression.

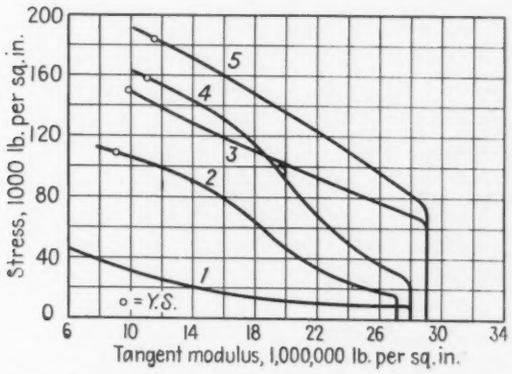


Fig. 2—Tangent modulus curves derived from stress-strain curves for steel H-204 containing 16.49 per cent manganese, 1.13 copper, 0.22 silicon, and 0.10 per cent carbon.

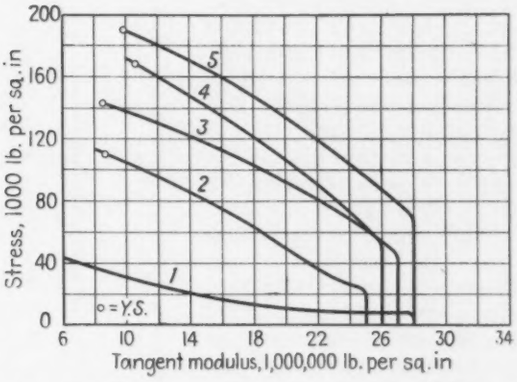


Fig. 3—Tangent modulus curves derived from stress-strain curves for steel H-641 containing 16.30 per cent manganese, 1.14 nickel, 1.11 copper, 0.27 silicon, and 0.10 per cent carbon.

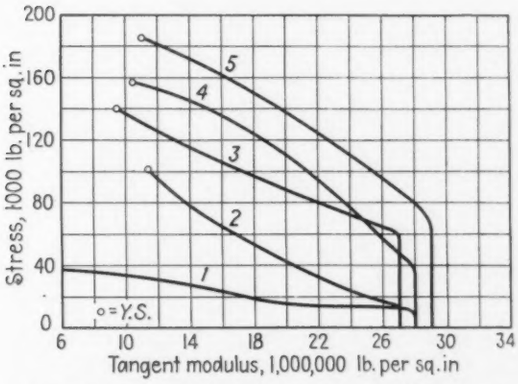


Fig. 4—Tangent modulus curves derived from stress-strain curves for steel H-689 containing 15.62 per cent manganese, 3.24 chromium, 1.00 nickel, 1.08 copper, 0.30 silicon, and 0.20 per cent carbon.

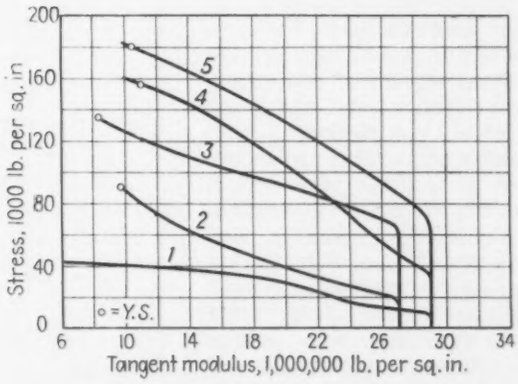


Fig. 5—Tangent modulus curves derived from stress-strain curves for steel H-604 containing 16.48 per cent manganese, 3.10 chromium, 1.83 nickel, 0.68 copper, 0.21 silicon, and 0.23 per cent carbon.

Curve 1 = Reduced 0 per cent by cold rolling and heat-treated at 1000 deg. C., compression; curve 2 = reduced 35 per cent by cold rolling, longitudinal direction, compression; curve 3 = reduced 35 per cent by cold rolling and heat-treated at 200 deg. C., longitudinal direction, compression; curve 4 = reduced 35 per cent by cold rolling, transverse direction, compression; curve 5 — reduced 35 per cent by cold rolling and heat-treated at 200 deg. C., transverse direction, compression.

and cold-rolled to strips of various thicknesses, which were investigated for tensile and compressive stress-strain characteristics. The tests were made in the longitudinal and transverse directions to rolling, both in the as-cold-rolled condition and after heat treating from 16 to 24 hr. at temperatures of about 200 deg. C. (392 deg. F.). The tensile tests were made on standard A.S.T.M. samples using suitable gages to measure the strain at different stress levels. The compression tests were made by the cylinder method,[4] which consists briefly of determining the compressive stress-strain characteristics of a cylindrical sample having a slenderness ratio of about 5, and a diameter to thickness ratio of about 40. In both the tension and compression tests the loads were applied with a 60,000 lb. Baldwin-Southwark testing machine. The gages were left on the samples until it was possible to determine the proportional limit at 0.01 per cent offset and the yield strength at 0.2 per cent offset,* but they were removed before the sample was fractured.

* *U. S. Navy Department Specification No. 47S21.*

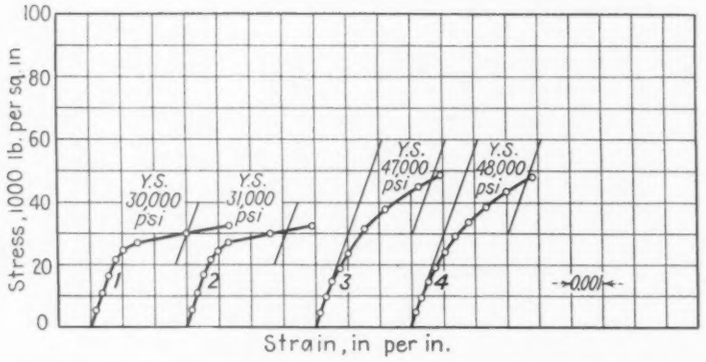
The results of tension and compression tests made on annealed and cold-rolled 0.035-in. thick strip samples of the 16 per cent manganese steels modified with small percentages of copper and nickel, with and without 3 per cent chomium are presented in Table I. They show that in the annealed condition which is obtained by heating the steels for several minutes at 1000 to 1050 deg. C. (1832-1922 deg. F.) and air cooling, all the steels are quite soft and have high ductility. The results further show that after reducing the steels about 35 per cent by cold rolling, they develop a high yield strength in both tension and compression, which is improved when the cold-rolled steels are stress relieved by heating from 16 to 24 hr. at about 200 deg. C. (392 deg F.), followed

by air cooling. The beneficial effect of the low temperature heat treatment on the ductility of the cold-rolled steels is especially marked, and shows that this treatment will aid in their fabrication into structural members.

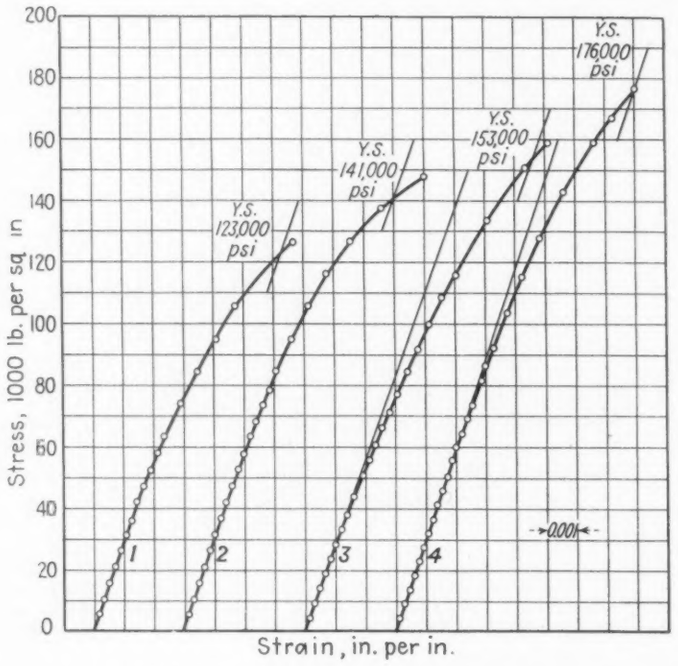
For the sake of brevity, all the stress-strain curves relating to the data of Table I are not presented. Only those representing the 16 per cent manganese steel containing about 1 per cent nickel and 1 per cent copper are given because they are typical for the steels of the group, which possess considerable resistance to progressive rusting when 3 per cent chromium is present. The stress-strain curves for this steel in the annealed condition, and after reducing 35 per cent by cold-rolling, are illustrated in Fig. 1. The data of this figure reveal that in the longitudinal direction to rolling, the cold-rolled steel has somewhat lower compression characteristics than in the transverse direction to rolling, whereas in tension, the stress-strain characteristics are quite similar in both directions to rolling. The tangent modulus curves for this steel and the other steels containing small additions of nickel and copper with 3 per cent chromium are illustrated by Figs. 2, 3, 4, and 5. It is shown by these tangent moduli curves that all of these cold-rolled steels have properties in compression similar to those of the cold-rolled stainless steels in compression. The important effect of the low temperature heat treatment (200 deg. C.) is clearly demonstrated by the tangent moduli curves. In every instance application of the treatment makes it possible for the steel to withstand higher stress at a given modulus. These curves also bring out that the initial tangent modulus of the heat treated steels in the cold-rolled condition is on the order of 28 million lb. per sq. in.

Similar tests were made on the 16 per cent manganese steel containing about 12 per cent chomium, and the results are given in Table II, and in Figs. 6 and 7. It is shown that the steel has high ductility and is soft in the annealed condition, and can be cold-rolled to high strength without too great a sacrifice of ductility. In fact the data for this steel indicate that it possesses a somewhat higher ductility with a given strength than some of the other steels. The initial tangent modulus of this steel is approximately 28 million lb. per sq. in. in both tension and compression. It can be said that in general the stress-strain characteristics of this steel are quite similar to those of the 17 per cent chromium and 7 per cent nickel steels after cold rolling. The beneficial effect of the stress-relieving heat treatment in improving both the yield strength and ductility is again in evidence, as the percent elongation in both the longitudinal and transverse directions to rolling, especially the latter, are almost doubled by this treatment.

An important requirement for steels of this class is that they be capable of being machined, bent, and formed into various articles.



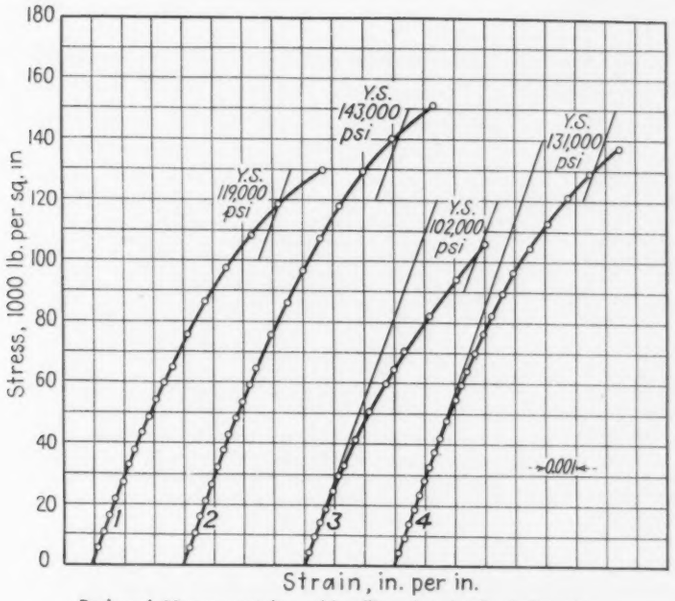
Reduced 0 per cent cold rolling, heat treated at 1050 deg. C. Curve 1 = longitudinal to direction of rolling, tension; curve 2 = transverse to direction of rolling, tension; curve 3 = longitudinal to direction of rolling, compression; curve 4 = transverse to direction of rolling, compression.



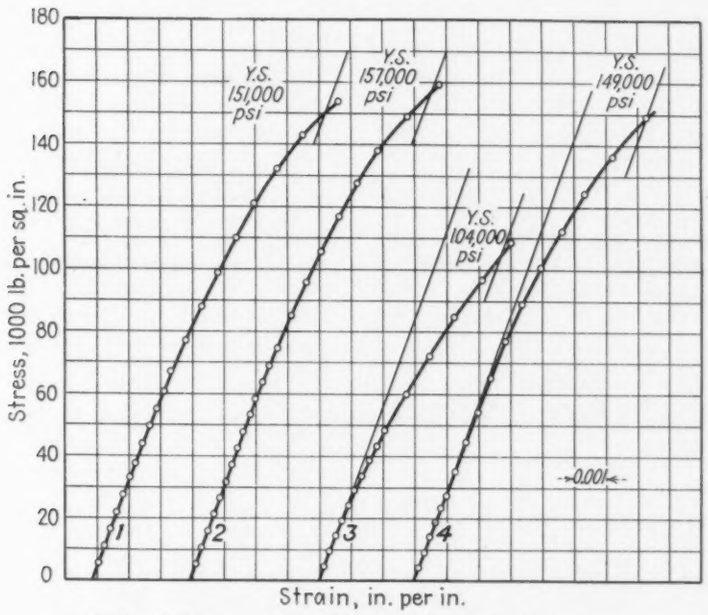
Reduced 33 per cent by cold rolling, transverse direction

Curve 1 = as cold-rolled, tension; curve 2 = cold-rolled and compression; curve 4 = cold-rolled and heat-treated at 200

Fig. 6—Stress-strain curves for steel SL-190 containing nickel, 0.20 silicon, and



Reduced 33 per cent by cold rolling, longitudinal direction.



Reduced 35 per cent by cold rolling, longitudinal direction.

heat-treated at 200 deg. C., tension; curve 3 = as cold-rolled, deg. C., compression.

15.76 per cent manganese, 12.25 chromium, 0.27 0.14 per cent carbon.

It has been found that all the steels can be turned, drilled, shaped, and sheared without difficulty provided their carbon contents are not too high. The carbon contents discussed in the paper are satisfactory for these operations. Higher carbon contents are detrimental to bending and forming, and especially to transverse bending, but if the carbon content is controlled as shown, the steels can be bent through an angle of 180 deg. without danger of cracking. As would be expected from the elongation values, the low temperature heat treatment also improves the bending properties of the cold-rolled steels.

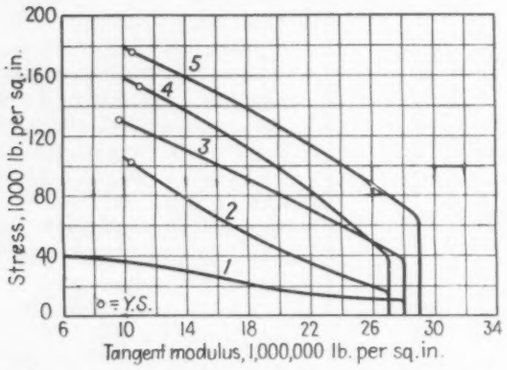
Another important requirement for these steels concerns their spot welding properties. Tests made in this connection showed that the various 16 per cent manganese steels could be successfully spot welded under the conditions ordinarily employed for the cold-rolled stainless steels. The tests were made on 0.035-in. thick strip, and the welds exceeded the strength of 1500 lb. for single spots, the minimum requirement for stainless steel strip of this thickness.

Tests were made on annealed and cold-rolled 0.035-in. thick strip samples of the steels at subnormal temperatures, and the results are given in Table III.

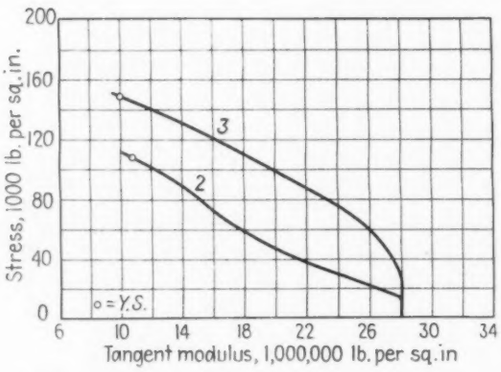
The bend tests on the annealed samples were made over a radius equivalent to the thickness of the strip, while the bends on the cold-rolled samples were made using a radius equal to three times the thickness of the strip. The results show that none of the steels became extremely brittle at any of the temperatures down to -65 deg. C. (-85 deg. F.) either in the annealed or cold-rolled condition, although the 16 per cent manganese steel containing 1 per cent copper did lose some ductility. The data further show that with small additions of nickel and copper, and 3 per cent chromium, the 16 per cent manganese steels retain their ductility unimpaired at temperatures down to -65 deg. C. (-85 deg. F.), which is an important consideration when, for example, airplanes fly at high altitudes. It is also pertinent that the 16 per cent manganese and 12 per cent chromium steel retains its ductility during exposure to these low temperatures. Similar bend tests were made on cold-rolled samples of the steels given the 200 deg. C. (392 deg. F.) treatment and equally satisfactory results were obtained.

A brief summary of the data given herein shows that the relatively low-carbon 16 per cent manganese steels with small additions of nickel and copper can be cold-rolled to high strength without serious loss of ductility. These steels are not free of progressive rusting, but their resistance to atmospheric corrosion is greatly improved by adding about 3 per cent chromium, which renders the steels more resistant to progressive rusting.

The 16 per cent manganese steel containing about 12 per cent chromium can also be cold-rolled to high strength with retention of good ductility. This steel has high



Curve 1 = reduced 0 per cent by cold rolling, and heat treated at 1050 deg. C., compression; curve 2 = reduced 33 per cent by cold rolling, longitudinal direction, compression; curve 3 = reduced 33 per cent by cold rolling, and heat treated at 200 deg. C., longitudinal direction, compression; curve 4 = reduced 33 per cent by cold rolling, transverse direction, compression; curve 5 = reduced 33 per cent by cold rolling, and heat treated at 200 deg. C., transverse direction, compression.



Curve 2 = reduced 35 per cent by cold rolling, longitudinal direction, compression; curve 3 = reduced 35 per cent by cold rolling, and heat treated at 200 deg. C., longitudinal direction, compression.

Fig. 7—Tangent modulus curves derived from stress-strain curves for steel SL-190 containing 15.76 per cent manganese, 12.25 chromium, 0.27 nickel, 0.20 silicon, and 0.14 per cent carbon.

resistance to atmospheric corrosion and is quite resistant to straining under such conditions, which make it suitable for light construction when adequate protection against atmospheric deterioration by a surface coating is not feasible.

The stress - strain characteristics of all these steels in the cold-rolled condition are definitely improved by application of the low temperature heat treatment at 200 deg. C. (392 deg. F.). This treatment benefits the ductility and bending properties of the cold-rolled steels and should be applied for optimum results. Furthermore, the steels have satisfactory spot welding characteristics and do not become brittle when exposed to subnormal temperatures (down to -65 deg. C. or -85 deg. F.), which are important assets to steels for lightweight high-strength structures.

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TABLE I

Tension and Compression Test Data Obtained on 0.035-in. Thick Strip of Modified Austenitic Manganese Steels

Heat No.	Chemical Composition, Per Cent						Per Cent Cold Reduction	Direction to Rolling	Condition of Metal	Tension						Compression			
	Mn	Cr	Ni	Cu	Si	C				Initial Tangent E in Million Lb. Per Sq. In.	Proportional Limit, 0.01 Per Cent Offset, Lb. Per Sq. In.	Yield Strength, 0.2 Per Cent Offset, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Elongation, Per Cent in 2 in.	Rockwell Hardness	Initial Tangent E in Million Lb. Per Sq. In.	Proportional Limit, 0.01 Per Cent Offset, Lb. Per Sq. In.	Yield Strength, 0.2 Per Cent Offset, Lb. Per Sq. In.	Buckling Stress, Lb. Per Sq. In.
H204	16.49	—	—	1.13	0.22	0.10	—	L	A	28	16,000	29,000	120,000	45	90B	28	16,000	45,000	76,100
							—	T	A	28	14,000	31,000	129,100	42		28	16,000	46,000	80,100
							35	L	1	28	58,000	139,000	195,500	18		27	32,000	109,000	175,200
							35	L	2	29	74,000	146,000	187,000	16		29	84,000	150,000	195,500
							35	T	1	28	63,000	131,000	191,800	9	43C	28	50,000	158,000	206,000
							35	T	2	28	95,000	150,000	189,500	12	44C	29	110,000	184,000	219,500
H641	16.30	—	1.14	1.11	0.27	0.10	—	L	A	28	17,000	33,000	132,000	55	85B	28	15,000	44,000	77,700
							—	T	A	28	23,000	34,000	127,700	50		28	16,000	45,000	78,800
							35	L	1	27	34,000	125,000	184,500	17		25	36,000	110,000	172,500
							35	L	2	28	41,000	139,000	181,800	17		27	73,000	143,000	185,600
							35	T	1	27	56,000	125,000	188,000	9	43C	26	86,000	168,000	202,000
							35	T	2	29	75,000	143,000	184,000	14	44C	28	113,000	190,000	215,500
H604	16.48	3.10	1.83	0.68	0.21	0.23	—	L	A	28	28,000	38,000	128,800	71	85B	29	22,000	50,000	73,200
							—	T	A	28	30,000	38,000	127,400	62		29	22,000	46,000	68,300
							35	L	1	27	51,000	135,000	187,800	22		27	26,000	91,000	160,200
							35	L	2	28	50,000	144,000	185,000	18		27	89,000	135,000	173,000
							35	T	1	29	63,000	133,000	190,000	8	42C	29	54,000	156,000	202,500
							35	T	2	29	85,000	146,000	190,800	8	44C	29	103,000	180,000	216,000
H689	15.62	3.24	1.00	1.08	0.30	0.20	—	L	A	28	20,000	31,000	132,600	65	84B	28	16,000	45,000	74,000
							—	T	A	28	26,000	34,000	137,400	74		27	19,000	47,000	73,700
							35	L	1	26	45,000	133,000	190,600	8		27	27,000	102,000	173,000
							35	L	2	26	82,000	146,000	190,500	24		27	83,000	140,000	182,800
							35	T	1	27	61,000	123,000	178,800	5	43C	28	55,000	157,000	198,000
							35	T	2	27	94,000	148,000	200,500	16	44C	29	96,000	185,000	216,000

A = Annealed by heating for several minutes at 1000 to 1050 deg. C. (1832-1922 deg. F.) and air cooling.
1 = Cold-rolled.
2 = Cold-rolled, heated 24 hr. at 209 deg. C. and air cooled.
L = Longitudinal to direction of rolling.
T = Transverse to direction of rolling.

TABLE II

Tension and Compression Test Data Obtained on 0.035-in. Thick Strip of Austenitic Manganese-Chromium Steel

Heat No.	Chemical Composition, Per Cent						Per Cent Cold Reduction	Direction to Rolling	Condition of Metal	Tensile					Rockwell Hardness	Compression			
	Mn	Cr	Ni	Cu	Si	C				Initial Tangent E in Million Lb. Per Sq. In.	Proportional Limit, 0.01 per cent Offset, Lb. Per Sq. In.	Yield Strength, 0.2 per cent Offset, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Elongation, Per Cent in 2 in.		Initial Tangent E in million Lb. Per Sq. In.	Proportional Limit, 0.01 Per Cent Offset, Lb. Per Sq. In.	Yield Strength, 0.2 Per Cent Offset, Lb. Per Sq. In.	Buckling Stress, Lb. Per Sq. In.
L190	15.76	12.25	0.27	—	0.20	0.14	—	L	A	28	24,000	30,000	142,800	67	82B	28	19,000	47,000	79,200
							—	T	A	28	25,000	31,000	144,200	64		28	21,000	48,000	77,500
							33	L	1	27	54,000	119,000	191,800	13		27	31,000	102,000	169,600
							33	L	2	27	63,000	143,000	197,600	24		28	60,000	131,000	175,500
							33	T	1	28	62,000	123,000	188,200	8	42C	27	58,000	153,000	194,800
							33	T	2	28	71,000	141,000	195,000	17	43C	29	93,400	176,000	207,500
							35	L	1	28	66,000	151,000	215,000	13	43C	28	28,000	104,000	189,400
							35	L	2	28	81,000	157,000	214,000	20	44C	28	71,000	149,000	197,800

A = Annealed by heating for several minutes at 1000 to 1050 deg. C. (1832-1922 deg. F.) and air cooling.
1 = As cold-rolled.
2 = Cold-rolled, heated 24 hr. at 200 deg. C. and air-cooled.
L = Longitudinal to direction of rolling.
T = Transverse to direction of rolling.

gineers, Iron and Steel Division, vol. 140, 1940, pp. 443-458.

[2] "Tension and Compression Stress-Strain Characteristics of Cold-Rolled Austenitic Chromium - Nickel and Chromium-Manganese-Nickel Stainless Steels," by Russell Franks and W. O. Binder, Journal of the Aeronautical Sciences, Vol. 9, No. 11, Sept., 1942.

[3] "Tensile and Compressive Properties of Some Stainless Steel Sheets," by C. S. Aitchison, Walter Ramberg, L. B. Tuckerman, and Herbert L. Whittemore, National Bureau of Standards, Journal of Research Paper RP-1467, March, 1942.

[4] "The Stress-Strain Characteristics of Cold-Rolled Austenitic Stainless Steels in Compression as Determined by the Cylinder Test Method," by Russell Franks and W. O. Binder, Proceedings, A. S. T. M., June, 1941, p. 629.

TABLE III

Results of Bend Tests at Subnormal Temperatures on the 16 Per Cent Manganese Steels

Heat No.	Composition, Per Cent					Condition of Strip Sample	Angle of Bend** Without Failure		
	Mn	Cr	Ni	Cu	C		Room Temp., 75 Deg. F.	32 Deg. F.	—85 Deg. F.
H204	16.49	—	—	1.13	0.10	Annealed*	180	180	120
						Cold Reduced 35 per cent by rolling	180	100	65
H641	16.30	—	1.14	1.11	0.10	Annealed*	180	180	180
						Cold reduced 35 per cent by rolling	180	180	100
H604	16.48	3.10	1.83	0.68	0.23	Annealed*	180	180	180
						Cold reduced 35 per cent by rolling	180	180	180
H689	15.62	3.24	1.00	1.08	0.20	Annealed*	180	180	180
						Cold reduced 35 per cent by rolling	180	180	180
SL190	15.76	12.25	0.27	—	0.14	Annealed*	180	180	180
						Cold reduced 35 per cent by rolling	180	180	180

* Heated several minutes at 1000 to 1050 deg. C, (1832-1922 deg. F.) and air cooled.
** Samples bent in both directions to rolling.

The Iron Age

Effect of Over-Annealing on Steel

A RECENT symposium, held by the British Institute of Physics, brought to light an interesting study of the effects of over-annealing steel on the magnetic qualities of the finally hardened steel. The examination was conducted by means of side reflection X-ray photographs taken of two pieces of hardened magnet, one with good and one with poor magnetic properties, and a similar study of two softened steels, one being over-annealed.

The X-ray technique consists of subjecting the specimen to a narrow vertical beam and photographing the side reflections on a flat piece of film placed facing the sample. By this method all four samples were examined. The two hardened magnets showed almost no differences except that distortion was present in varying amounts, even though their respective hardness values showed a difference of about 200 points on the Vicker's Diamond Hardness scale.

The steels in the softened condition, however, showed striking differences indicating that prolonged heating increases the amount of formed carbide and promotes crystalline growth of both the carbide and iron phases. Further examination proved that the steel having normal softening showed small amounts of formed carbide and very small crystalline structure and had good magnetic properties. The opposite was true of the over-annealed specimen.

The reason for the poor magnetic properties of the hardened steel which had been over-annealed relate to the fact that the normal pre-heating time, at the temperature from which the steel is to be hardened, does not allow the whole of the precipitated carbide to re-enter into solid solution. Thus, the rapid cooling in the hardening operation cannot produce the maximum hardness to be expected with correct heating schedules. In consequence, the magnetic properties of the steel are below those for the fully hardened steel.

D. C. Seam Welding

. . . Seam welds are now being made in thin gage steel at the rate of 140 ft. per min., using direct current rectified from a three-phase a.c. source. Tripling the speed of conventional a.c. machines puts this d.c. seam welding process in an entirely new competitive position as regards other methods of joining sheets and opens up applications never before considered for resistance welding.

By T. W. DIETZ

Research Engineer, The Taylor Winfield Corp., Warren, Ohio

THE steadily rising trend toward increased manufacturing speeds and lower costs has caused manufacturers to turn more and more to resistance welding. The welding industry, in turn, has found it necessary to improve and refine its product to meet this demand and where possible to anticipate future demands.

Seam welding is frequently used to produce a leak proof joint between two sheets of metal. As it has been commercially done, it has had a very definitely limited speed, due to the 60 cycle current. For example, two pieces of 0.024 in. sheet steel require about 12 spots per in. to make a gas tight seam weld. Since each half cycle makes a spot, this limits the speed to approximately 50 ft. per min. On thinner materials the spots should be smaller and, therefore, should be closer together to overlap sufficiently. For this reason the limiting speeds would be lower. There are two ways in which this difficulty can be circumvented. High frequency current will make the spots closer together. Direct current will make a continuous seam.

Currents of frequencies higher than 60 cycles increase the other difficulties encountered in alternating current welding. Inductance remains essentially constant and hence the inductive reactance varies roughly as the first power of the frequency. The resistance of the heavy sections of copper which form the throat of a welder also shows an appreciable increase with increase in frequency. The exact function of resistance as related to frequency varies with respect to the shape and size of the copper section, so that it cannot readily be determined. The high line-demand caused by high inductive reactance can be compensated for by the use of condensers, but nothing can be done about the increased loss due to the higher alternating current resistance. Any steel in the throat of a high frequency welder, whether it be part of the construction of the machine or the material being welded, would be subject to excessive inductive heating and would greatly affect the impedance of the machine.

Direct current is not affected by the inductance of the throat of a welder after steady state, where $I = E/R$, has been reached. (Approximately 0.016 sec. in the average welder.) This gives the mechanical designer much more freedom than he has had with any other type of energy. Resistance voltage drops are also greatly reduced, because the current distribution is uniform throughout the copper section.

A satisfactory source of direct current for welding must meet rather specialized conditions. It must have a low internal impedance and high current capacity. It must be compact. It must have a long life and be free from excessive servicing. Voltage and current must not vary from one application of load to another.

The voltage drop through mercury tubes is constant at approximately 15 volts. This is several times the voltage necessary for seam or spot welding and so would make a very inefficient circuit. Rotating generators would be costly and would probably introduce commutating difficulties. Armature reaction in a direct current generator causes reduction in voltage as load comes on, by weakening the field. When the load is removed, the field does not immediately recover and may still be in this weakened condition when the load is again applied. This would result in non-uniform welds. Switching of welding currents (as high as 50,000 amp., or more) would also produce serious switching difficulties. Storage batteries would give rise to the same switching problems as generators. They would require frequent servicing and in addition would require some form of charging circuit which would either charge the batteries continuously or would charge only during the idle time.

Dry disk rectifiers, however, when connected to form a three-phase full wave rectifier, seem to meet the above mentioned requirements better than any other direct current source. Their inherent low voltage and high current characteristics make for good efficiency. Several combinations of materials produce an electrical valve action, but of commercially available apparatus the familiar copper oxide rectifier and the copper sulphide magnesium rectifier have so far appeared to be best suited to welding service. The reliability of both types is well established and their high current, low voltage ratings (2 to 3 volts) are ideal for welding. Rectifier junctions may be paralleled quite satisfactorily, thus making a compact and reliable rectifier.

Fig. 1 shows a schematic diagram of the power circuit of a typical direct current welder with tapped transformer primary for heat control and switching device for application of power.

On single-phase a.c. welding, transient currents produced by cutting in on different parts of the voltage wave at the start of the cycle are not uniform and produce a non-uniform weld, especially on short time spot welds, unless synchronous timing is used. This necessitates the use of costly control equipment. Starting on different points of a three-phase voltage wave does not "show through" the rectifier since each of the three phases will be hit at three different points on the voltage, 120 electrical degrees apart. The oscillogram, Fig. 2 shows this uniformity of direct current with random starting with respect to the a.c. input.

An automatic high speed seam welder is now satisfactorily welding two thicknesses of 0.011 in. sheet steel at the rate of 140 ft. per min. with direct current, using copper oxide rectifiers. The design of this machine is such that large sections of ferrous structures actually encircle the conductors of the weld current. The design also requires that the rectifiers be mounted beside the welder, so that the effective distance from the current source to the welding electrodes is in excess of 10 ft. In spite of this long length of copper, the welding is accomplished at 1.5 volts d.c. measured at the rectifier terminals. This is a production machine, built to replace other methods of making a gas tight seam. It saves vital materials and in order to compete with the previously established process, must run at or near the 140 ft. per min. speed, which is about three times the maximum speed possible with 60-cycle welding.

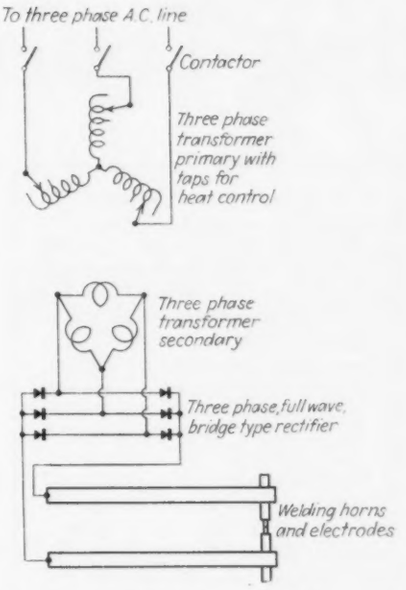


Fig. 1—Schematic diagram of the power circuit of a typical d.c. welding set-up, using a three-phase dry disk type of rectifier on the secondary side of the welding transformer.

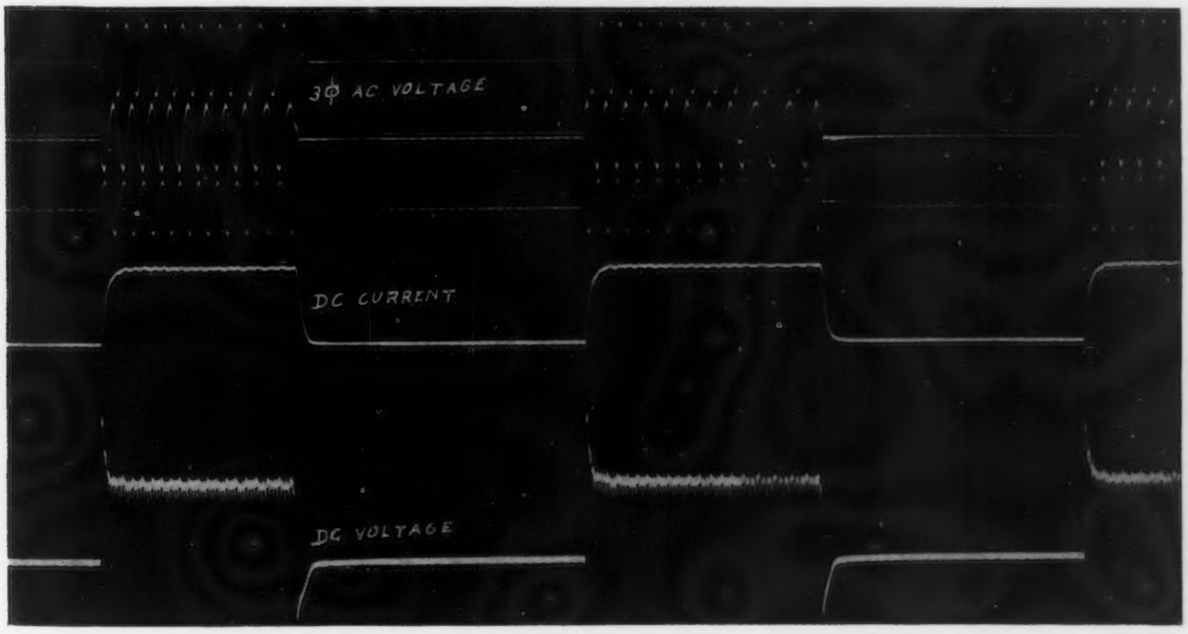
o o o

Fig. 2—An oscillogram of the circuit shown schematically in Fig. 1. Note that a stabilized condition of d.c. voltage and current is reached in a brief instant and that the current build up does not vary with random starting on the a.c. voltage wave.

A comparison of line demands of a conventional 60-cycle welder with a 48-in. throat, 8-in. horn spacing, and 2½ in. diameter horns, with an identical setup energized with direct current, shows the d.c. welder to have a distinct advantage over the other.

At 15,000 amp., the a.c. welder draws 111 kva. single phase, while a properly designed rectifier connected to the platens of the same welder draws only 55 kva., three phase. It is commonly known that a three-phase load produces less line disturbance than the same single-phase load.

In conclusion, it appears that direct current is applicable to most resistance welding problems. It is proving itself every day in stored energy welders. Direct current from a steady output source, such as rectifiers, is the only type of energy that could have been used in the particular high speed seam welder mentioned earlier in this article. In many instances the cost of the equipment would make it uneconomical to use rectifiers, but on the other hand it already has opened a new field to resistance welding in the form of extremely high speed seam welding. Analysis of difficulties encountered in other applications, indicates that it may be advantageously used in many places.



How to Select Efficient Cutting Tools

By LEO J. ST. CLAIR
President, General Tool & Die Co., East Orange, N. J.

SINCE there are many types of cutting tools available for use, it becomes important to select the best type of tool for a particular job in order to secure the greatest machining efficiency, longest tool life and the lowest machining costs. During 19 years of experience with cutting tools, the writer has been faced countless times with the decision of what type of tool to use. Through trial and error and subsequent reasoning as to why a certain type of tool did better than another type, it was found that the correct answer followed a certain pattern created by the three basic qualities which all types of cutting tools have, namely:

(1) Room temperature hardness
(2) "Red" hardness
(3) Toughness

It was invariably found that the most efficient tool excelled in one or two of the three basic qualities that was most needed for the job involved. For instance, a carbide tool could not be used to take a very heavy cut on a tough steel casting because of tool breakage. Why did the carbide tool break? The stresses produced by the cut due to the high tensile strength of the casting and the heavy cut were more than what the toughness of the carbide tool could stand. Hence, on such a job the proper type of cutting tool had to excel in toughness in order to cope with the great cutting stresses. This condition dictated the use of 18-4-1 high speed steel with a hardness of about 61 to 63 Rockwell "C."

On the other hand, a light cut on aluminum would not require a tool with much toughness since aluminum has a comparatively low tensile strength and the tool would not need much red hardness, since such a cut would generate relatively little heat. Therefore, a tool with a high room temperature hardness would be the most efficient, and the best choice would be a hard grade of carbide tool. If this wasn't available, and H.S.S. was available, this H.S.S. tool should be made as hard as possible to give the best results since toughness would not be required.

Eventually, the writer began to analyze each job to be done with respect to the tensile strength of the material to be cut and whether the cut was light, medium or heavy. From this analysis it could be determined which basic quality a tool must excel in to do this work. It was then only necessary to choose a type of tool that would have this basic quality over and above other types of tools. From actual experience this method proved to be sound.

One day this procedure was being explained to a tool engineer who had called the writer in to analyze a particular machining job. He suggested that if these ideas could be put down in a simplified chart form, it would be an excellent guide. The result of this suggestion is the chart shown on the opposite page. This chart was "field tested" many times before publication. From such field tests came very valuable suggestions in the matter of presentation and simplification, which have been incorporated in it.

The centrifugally cast alloy material listed as type No. 3 on the table deserves some further explanation. Its trade name is Kut Kost and was introduced by the General Tool & Die Co. about six months ago. Even though two years of laboratory testing showed that a brand new cutting material had been developed, its introduction was made very cautiously in one plant only. This plant had particularly difficult cutting problems. The results secured as compared with high speed steel tools, were very satisfactory. It also stood up on the tough operations where carbide tools were underspeeded and where breakage and chipping was excessive.

Tests have since been made in other plants and these have also proved to be satisfactory. The writer's company is now preparing to introduce this new material on a broader basis. The price will be a little above the price of the present cast alloy tools having high percentages of cobalt, chromium and tungsten.

Kut Kost contains a high percentage of tungsten and cobalt, 1½ per cent of boron along with other metals not ordinarily associated with cutting materials. The boron forms boron carbide particles which are harder than tungsten carbide

• • • The author who compiled the chart on the facing page is a cutting tool specialist. He has been "in" on cemented carbide tools from their first beginnings in this country inasmuch as he worked with Dr. Samuel Hoyt and others at General Electric Co. on the initial use of cemented carbide tools in 1925, many years before the Carboloy Co. was formed. Mr. St. Clair started in the two-year factory training course at G.E. in Schenectady in 1923 shortly after his graduation from the University of Maine. It was during this course that the study of cutting tools became a hobby and a constant source of interest. When the Carboloy Co. was formed in 1929, Mr. St. Clair went to Philadelphia as branch manager. In 1937 he was established at Newark, N. J., as Eastern manager. While in Newark, he set up a school for Carboloy tool users. Mr. St. Clair formed the General Tool & Die Co. in 1939 for the purpose of manufacturing all types of cutting tools. In 1940 he worked out two new processes of tipping high speed steel by brazing or welding hardened pieces to low alloy shanks. These processes have been described in THE IRON AGE, March 26 and Aug. 6, 1942. Mr. St. Clair has also helped to develop a new type of cutting alloy which is described in the accompanying text.

A GUIDE FOR THE PROPER CHOICE OF CUTTING TOOLS

TYPES OF CUTTING TOOL MATERIALS IN USE TODAY:

	Abbreviations
1. DIAMOND	
2. CEMENTED CARBIDE	Carbide
3. CENTRIFUGALLY CAST ALLOY (Kutkost)	C. Cast Alloy
4. PLAIN CAST ALLOYS OF COBALT, CHROMIUM and TUNGSTEN	P. Cast Alloy
5. COBALT HIGH SPEED STEEL (5%, 8%, 12% Cobalt Content)	Cobalt H.S.S.
6. 18-4-1 or MOLYBDENUM HIGH SPEED STEEL	Plain H.S.S.

CUTTING TOOL MATERIALS HAVE THREE BASIC QUALITIES:

	Abbreviations
1. ROOM TEMPERATURE HARDNESS	R. T. Hardness
2. "RED" HARDNESS (Hardness at High temperatures)	
3. TOUGHNESS	

Each type of cutting tool excels in one or two of the three qualities mentioned above and is deficient in one or two of these qualities. No one tool material can excel in all three qualities.

CHOICE OF TOOL MATERIAL DEPENDS ON:

1. THE TYPE OF WORK TO BE DONE—which may be broadly classified as LIGHT, MEDIUM and HEAVY CUTS on
   1. Low Tensile Strength Materials
   2. High Tensile Strength Materials
2. THE BASIC QUALITY IN THE TOOL THAT IS MOST NEEDED TO DO THE JOB UNDER CONSIDERATION (See above)

For Example: A light cut on a low tensile strength material such as aluminum requires a tool that excels in ROOM TEMPERATURE HARDNESS since this type of cut does not require a tool with much "RED" HARDNESS (cut does not generate much heat) nor a tool with much TOUGHNESS (due to low tensile strength of aluminum)

CHOICE OF TOOLS WILL BE INFLUENCED BY REMARKS IN FOOTNOTES A, B, C, D, E and F

CLASSIFICATION OF TYPES OF CUTTING TOOL MATERIALS IN THE ORDER OF THEIR EXCELLENCE WITH RESPECT TO THE THREE BASIC QUALITIES OF CUTTING TOOLS:

ROOM TEMPERATURE HARDNESS

	Order of Excellence
1. DIAMOND TOOL	Hardest
Hard: 91-92 Rockwell "A"	
2. CEMENTED CARBIDE TOOL	
Hard: 89-91 Rockwell "A"	
3. CENTRIFUGALLY CAST ALLOY TOOL	
Hard: 58-64 Rockwell "C"	
4. PLAIN CAST ALLOYS OF COBALT, CHROMIUM and TUNGSTEN TOOL	
Hard: 58-64 Rockwell "C"	
5. COBALT HIGH SPEED STEEL TOOL	
Hard: 63-65 Rockwell "C"	
6. 18-4-1 or MOLYBDENUM HIGH SPEED STEEL TOOL	
Hard: 63-65 Rockwell "C"	

"RED" HARDNESS

	Order of Excellence
1. DIAMOND TOOL	Highest
2. CEMENTED CARBIDE TOOL	
3. CENTRIFUGALLY CAST ALLOY TOOL	
4. PLAIN CAST ALLOYS OF COBALT, CHROMIUM and TUNGSTEN TOOL	
5. COBALT HIGH SPEED STEEL TOOL	
6. 18-4-1 or MOLYBDENUM HIGH SPEED STEEL TOOL	

TOUGHNESS

	Order of Excellence
1. PLAIN H.S.S. TOOL	Strongest
2. COBALT HIGH SPEED STEEL TOOL	
3. 18-4-1 or MOLYBDENUM HIGH SPEED STEEL TOOL	
4. CENTRIFUGALLY CAST ALLOY TOOL	
5. PLAIN CAST ALLOYS OF COBALT, CHROMIUM and TUNGSTEN TOOL	
6. CEMENTED CARBIDE TOOL	
7. DIAMOND TOOL	Least

ROOM TEMPERATURE HARDNESS

		Order of Excellence
1. DIAMOND TOOL		Hardest
2. CARBIDE TOOL	Hard: 91-92 Rockwell "A" Med. Hard: 89-91 Rockwell "A" Soft: 87-89 Rockwell "A"	Very Good
3. C. CAST ALLOY TOOL	Hard: 68-70 Rockwell "C" Med. Hard: 65-67 Rockwell "C" Soft: 61-63 Rockwell "C"	Good
4. COBALT H.S.S. TOOL	Hard: 65-67 Rockwell "C" Med. Hard: 63-64 Rockwell "C" Soft: 61-62 Rockwell "C"	Fair
5. PLAIN H.S.S. TOOL	Hard: 65-67 Rockwell "C" Med. Hard: 63-64 Rockwell "C" Soft: 61-62 Rockwell "C"	Fair
6. P. CAST ALLOY TOOL	60-62 Rockwell "C"	Softest

"RED" HARDNESS

Order of Excellence

1. DIAMOND TOOL . . . . . Highest
2. CARBIDE TOOL . . . . . Very Good
3. C. CAST ALLOY TOOL . . . . . Good
4. P. CAST ALLOY TOOL . . . . . Good
5. COBALT H.S.S. TOOL . . . . . Fair
   (The higher the cobalt content the higher is the "red" hardness.)
6. PLAIN H.S.S. TOOL . . . . . Lowest

(NOTE: Speed in Feet Per Minute influences heat generation. When high speed can be used the quality of "red" hardness becomes of greater importance than if medium or low speeds are available due to the higher heat generation at the higher speeds.)

TOUGHNESS

Order of Excellence

1. PLAIN H.S.S. TOOL . . . . . Strongest
2. COBALT H.S.S. TOOL . . . . . Good
3. C. CAST ALLOY TOOL . . . . . Good
4. P. CAST ALLOY TOOL . . . . . Fair
5. CARBIDE TOOL . . . . . Fair
6. DIAMOND TOOL . . . . . Weakest

(Due to great lack of toughness and their high cost, use of diamond tools is very limited.)

(NOTE: Nos. 1, 2, 3 and 5 TOOLS will vary in toughness according to their hardness. The soft grades are tougher than the hard grades.)

CLASSIFICATION OF KIND OF WORK TO BE DONE with respect to the MOST IMPORTANT BASIC TOOL QUALITY, together with the *first, second* and *third* CHOICE OF TOOL best suited for work.

(Occasionally a fourth choice of tool is added.)

	LIGHT CUTS (Feeds up to .010 in. and depths up to 1/8 in.)	MEDIUM CUTS (Feeds from .010 to .030 in. and depths up to 3/16 in.)	HEAVY CUTS (Feeds of more than .030 in. and depths up to 3/8 in.)
BAKELITE, HARD RUBBER and PLASTICS Up to 10,000 lb. strength	R. T. HARDNESS MOST IMPORTANT (Cut does not generate much heat nor requires much strength in tool.) CHOICE OF TOOL MATERIAL: 1st—Diamond 2nd—Hard Carbide 3rd—Hard C. Cast Alloy	R. T. HARDNESS MOST IMPORTANT (Cut does not generate much heat but requires more toughness than on light cut.) CHOICE OF TOOL MATERIAL: 1st—Hard Garbide 2nd—Hard C. Cast Alloy 3rd—Hard Cobalt or Plain H.S.S.	R. T. HARDNESS MOST IMPORTANT (Cut does not create much heat but requires more toughness than on medium cuts.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Carbide 2nd—Medium Hard C. Cast Alloy 3rd—Hard Cobalt or Plain H.S.S.

			3rd—Hard Cobalt or Plain H.S.S.	Cast Alloy 3rd—Hard Cobalt or Plain H.S.S.
LOW TENSILE STRENGTH MATERIALS Up to 40,000 lb. per sq. in. tensile strength	COPPER, PLAIN BRASS, PLAIN BRONZE, ALUMINUM, MAGNESIUM Up to 20,000 lb. strength	R. T. HARDNESS MOST IMPORTANT (Cut does not create much heat nor requires much toughness.) CHOICE OF TOOL MATERIAL 1st—Diamond for very shallow cuts (Carbide for light cuts) 2nd—Hard C. Cast Alloy 3rd—Hard Cobalt or Plain H.S.S.	R. T. HARDNESS MOST IMPORTANT (Cut does create much heat but requires more toughness than on a light cut.) CHOICE OF TOOL MATERIAL 1st—Medium Hard Carbide 2nd—Medium Hard C. Cast Alloy 3rd—Hard Cobalt or Plain H.S.S.	R. T. HARDNESS MOST IMPORTANT (Cut does not create high heat but requires more toughness than on medium cuts.) CHOICE OF TOOL MATERIAL 1st—Medium Hard Carbide (Soft Carbide if cut is deeper than 3/8 in.) 2nd—Medium Hard C. Cast Alloy (Soft C. Cast Alloy if cut is deeper than 3/8 in.) 3rd—Medium Hard Cobalt or Plain H.S.S.
	PLAIN SOFT CAST IRON and TOUGH ALLOY BRASS, BRONZE or ALUMINUM Up to 40,000 lb. strength	R. T. HARDNESS MOST IMPORTANT (Cut creates fair amount of heat so that tool should have good red hardness also. Not much toughness required.) CHOICE OF TOOL MATERIAL 1st—Hard Carbide (Medium Hard Carbide if cut is deeper than 1/8 in.) 2nd—Medium Hard C. Cast Alloy or P. Cast Alloy 3rd—Hard Cobalt or Plain H.S.S.	R. T. HARDNESS MOST NEEDED, PLUS GOOD RED HARDNESS (Cut creates quite a bit of heat, hence red hardness is also needed. Due to low tensile, not much toughness needed.) CHOICE OF TOOL MATERIAL 1st—Medium Hard Carbide 2nd—Medium Hard C. Cast Alloy or P. Cast Alloy Tool 3rd—Medium Hard Cobalt H.S.S. (P. C. Alloy Tool if cut is deeper than 3/16 in.)	RED HARDNESS MOST NEEDED, PLUS FAIR TOUGHNESS (Cut creates good deal of heat and red hardness becomes most important. Size of cut requires toughness also.) CHOICE OF TOOL MATERIAL 1st—Soft Carbide 2nd—Soft C. Cast Alloy or P. Cast Alloy 3rd—Medium Hard Cobalt H.S.S.
	TOUGH ALLOY IRON, and SEMI-STEEL IRON From 40,000 to 60,000 lb. strength. Similar to: Meehanite, chrome iron, 20% to 60% steel iron, etc.	R. T. HARDNESS MOST NEEDED, PLUS FAIR RED HARDNESS (Cut creates fair amount of heat, but does not generally require much toughness due to light cut.) CHOICE OF TOOL MATERIAL 1st—Hard Carbide (Medium Hard Carbide, if cut is deeper than 1/8 in.) 2nd—Medium Hard C. Cast Alloy or P. Cast Alloy 3rd—Hard Cobalt H.S.S. (P. Cast Alloy, if cut is deeper than 1/8 in.)	RED HARDNESS MOST NEEDED, PLUS FAIR TOUGHNESS (Cut creates much heat and requires fair toughness due to size of cut.) CHOICE OF TOOL MATERIAL 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than 3/16 in.) 2nd—Medium Hard C. Cast Alloy (Soft C. Cast Alloy, if cut is deeper than 3/16 in.) 3rd—P. Cast Alloy 4th—Medium Hard Cobalt H.S.S.	RED HARDNESS MOST NEEDED, PLUS GOOD TOUGHNESS (Cut creates high heat. Toughness becomes important due to size of cut.) CHOICE OF TOOL MATERIAL 1st—Soft Carbide 2nd—Soft C. Cast Alloy 3rd—P. Cast Alloy 4th—Soft Cobalt H.S.S.
HIGH	LOW CARBON STEEL and LOW CARBON ALLOY STEEL From 50,000 to 70,000 lb. strength.	R. T. HARDNESS MOST NEEDED, PLUS FAIR RED HARDNESS (Cut creates fair amount of heat, but does not generally require much toughness due to light cut.) CHOICE 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than 1/8 in.) 2nd—Medium Hard C.	RED HARDNESS MOST NEEDED, PLUS FAIR TOUGHNESS (Cut creates high heat and requires fair toughness due to size of cut.) CHOICE 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than 3/16 in.) 2nd—Medium Hard C.	TOUGHNESS MOST NEEDED, PLUS FAIR RED HARDNESS (Cut requires toughness due to its size and also requires red hardness because of high heat generation.) CHOICE 1st—Soft C. Cast Alloy 2nd—P. Cast Alloy 3rd—Soft Cobalt H.S.S.

HIGH TENSILE STRENGTH MATERIALS

From 40,000 lb. strength upwards.

SEMI-STEEL IRON From 40,000 to 60,000 lb. strength. Similar to: Meehanite, chrome iron, 20% to 60% steel iron, etc.	generally require much toughness due to light cut.) CHOICE OF TOOL MATERIAL: 1st—Hard Carbide (Medium Hard Carbide, if cut is deeper than ⅛ in.) 2nd—Medium Hard C. Cast Alloy or P. Cast Alloy 3rd—Hard Cobalt H.S.S. (P. Cast Alloy, if cut is deeper than ⅛ in.)	ness due to size of cut.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than 3/16 in.) 2nd—Medium Hard C. Cast Alloy (Soft C. Cast Alloy, if cut is deeper than 3/16 in.) 3rd—P. Cast Alloy 4th—Medium Hard Cobalt H.S.S.	tant due to size of cut.) CHOICE OF TOOL MATERIAL: 1st—Soft Carbide 2nd—Soft C. Cast Alloy 3rd—P. Cast Alloy 4th—Soft Cobalt H.S.S.
LOW CARBON STEEL and LOW CARBON ALLOY STEEL From 50,000 to 70,000 lb. strength. Similar to: SAE 1010, 1020, 1030, 2310, 3110, 4110, etc.	**R. T. HARDNESS MOST NEEDED, PLUS FAIR RED HARDNESS** (Cut creates fair amount of heat, but does not generally require much toughness due to light cut.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than ⅛ in.) 2nd—Medium Hard C. Cast Alloy 3rd—Plain Cast Alloy 4th—Hard Cobalt H.S.S. (A high percentage cobalt content best)	**RED HARDNESS MOST NEEDED, PLUS FAIR TOUGHNESS** (Cut creates high heat and requires fair toughness due to size of cut.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than 3/16 in.) 2nd—Medium Hard C. Cast Alloy 3rd—P. Cast Alloy 4th—Medium Hard Cobalt H.S.S.	**TOUGHNESS MOST NEEDED, PLUS FAIR RED HARDNESS** (Cut requires toughness due to its size and also requires red hardness because of high heat generation.) CHOICE OF TOOL MATERIAL: 1st—Soft C. Cast Alloy 2nd—P. Cast Alloy 3rd—Soft Cobalt H.S.S. 4th—Medium Hard Plain H.S.S. (Under ideal conditions, soft carbide tool can be 1st choice.)
HIGH CARBON STEEL, MEDIUM CARBON ALLOY STEEL From 70,000 to 120,000 lb. strength. Similar to: SAE 1040, 1050, 1060, 2320, 2330, 2340,	**RED HARDNESS MOST NEEDED, PLUS FAIR R. T. HARDNESS** (Cut generates high heat due to high tensile strength of material being cut. Not much toughness required.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than ⅛ in.) 2nd—Medium Hard C. Cast Alloy 3rd—Plain Cast Alloy	**TOUGHNESS NECESSARY, PLUS FAIR RED HARDNESS** (Cut requires toughness due to high tensile, and red hardness due to high heat generation.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than 3/16 in.) 2nd—Soft C. Cast Alloy 3rd—P. Cast Alloy 4th—Medium Hard Co-	**TOUGHNESS MOST NEEDED** (Cut requires great toughness because of high tensile strength of material being cut and size of cut.) CHOICE OF TOOL MATERIAL: 1st—Medium Hard Plain H.S.S. (Soft Plain H.S.S., if cut is deeper than ⅜ in.) 2nd—Soft Cobalt H.S.S. (low Co. percentage best) 3rd—Soft C. Cast Alloy

lb. strength.

Similar to:

SAE 1040, 1050, 1060, 2320, 2330, 2340, 3120, 3130, 3140, etc.

CHOICE OF TOOL MATERIAL

1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than ⅛ in.)
2nd—Medium Hard C. Cast Alloy
3rd—Plain Cast Alloy
4th—Medium Hard Cobalt H.S.S. (A 12% cobalt content best)

CHOICE OF TOOL MATERIAL

1st—Soft Carbide (Medium Hard Cobalt H.S.S., if cut is deeper than 3/16 in.)
2nd—Soft C. Cast Alloy
3rd—P. Cast Alloy
4th—Medium Hard Cobalt H.S.S. (Medium percentage cobalt content best)

CHOICE OF TOOL MATERIAL

1st—Soft Plain H.S.S., if cut is deeper than ⅜ in.)
2nd—Soft Cobalt H.S.S. (low Co. percentage best)
3rd—Soft C. Cast Alloy
4th—P. Cast Alloy

VERY TOUGH ALLOY STEEL

H. S. S. — STAINLESS and HIGH MANGANESE STEEL

Similar to:

SAE 2350, 2360 & up in "C"
3150, 3160 & up in "C"
4150, 4160 & up in "C"
5150, 5160 & up in "C"
5250, 5260 & up in "C"
6150, 6160 & up in "C"
etc.
18-8 Stainless

RED HARDNESS MOST NEEDED, PLUS FAIR TOUGHNESS

(Cut generates very high heat due to high tensile of material being cut. Toughness also important.)

CHOICE OF TOOL MATERIAL

1st—Medium Hard Carbide (Soft Carbide, if cut is deeper than ⅛ in.)
2nd—Medium Hard C. Cast Alloy (Soft C. Cast Alloy, if cut is deeper than ⅛ in.)
3rd—Plain Cast Alloy
4th—Medium Hard Cobalt H.S.S. or Hard Plain H.S.S.

TOUGHNESS NECESSARY, PLUS FAIR RED HARDNESS

(Cut requires toughness due to high tensile of material being cut and red hardness due to high heat generation.)

CHOICE OF TOOL MATERIAL

1st—Soft Carbide (Medium Hard Cobalt H.S.S., if cut is deeper than 3/16 in.)
2nd—Soft C. Cast Alloy
3rd—Medium Hard Plain H.S.S.
4th—P. Cast Alloy

TOUGHNESS MOST NEEDED

(Cut requires great toughness because of high tensile strength of material being cut and size of cut.)

CHOICE OF TOOL MATERIAL

1st—Soft Plain H.S.S.
2nd—Soft Cobalt H.S.S.
3rd—Soft C. Cast Alloy
4th—P. Cast Alloy

FOOTNOTES

NOTE A—FIRST CHOICE TOOL ON CHART BASED ON CONTINUOUS CUTS ON MACHINE TOOLS IN GOOD CONDITION. IF JUMP OR UNEVEN CUTS ARE INVOLVED, OR IF MACHINE TOOL IS IN POOR CONDITION, SECOND (OR THIRD OR FOURTH) CHOICE TOOL OFTEN BECOMES FIRST CHOICE TOOL. IN SUCH CASES FIRST CHOICE TOOL ON CHART IS DISPLACED ENTIRELY. GENERALLY, ON MILLING CUTS, 2ND, 3RD OR 4TH CHOICE TOOL BECOMES FIRST CHOICE, EXCEPT FOR MILLING NON-FERROUS MATERIALS.

NOTE B—ON STEEL CUTS, WHERE CARBIDE TOOLS ARE GIVEN FIRST CHOICE, SUFFICIENT SPEED MUST BE AVAILABLE TO OPERATE THE CARBIDE TOOLS PROPERLY. IF SUFFICIENT SPEED IS NOT AVAILABLE, USE NEXT CHOICE OF TOOL.

NOTE C—ON TOOLS THAT REQUIRE GREAT TORSIONAL STRENGTH, SUCH AS DRILLS, TAPS, ETC., TOOL MATERIAL WITH GREATEST TOUGHNESS IS REQUIRED. HENCE 18-4-1 OR MOLYBDENUM H.S.S. IS BEST SUITED.

NOTE D—MACHINING WORK ON STEEL CASTINGS OFTEN REQUIRES THE ELIMINATION OF FIRST CHOICE TOOL AND SUBSTITUTION OF 2ND, 3RD OR 4TH CHOICE.

NOTE E—CARBIDE TOOLS AND PLAIN CAST ALLOY TOOLS CANNOT BE ANNEALED AND THE CENTRIFUGALLY CAST ALLOY TOOL CANNOT BE ANNEALED SUFFICIENTLY FOR MACHINING. INABILITY TO MACHINE SUCH TOOL MATERIAL OFTEN EXCLUDES THEIR USE. TIPPING OFTEN OVERCOMES THIS PROBLEM.

NOTE F—EXCEPT FOR CUTTING NON-FERROUS MATERIALS, THE CEMENTED CARBIDES ARE NOT GENERALLY SUITABLE FOR WIDE FORM TOOLS BECAUSE OF THE GREAT "DEPTH" OF CUT (EQUALS WIDTH OF THE TOOL IN STRAIGHT INFEED).

TO USE CHART—Decide if material to be cut has low or high tensile strength, and decide if cut is light, medium or heavy. Then check choice of tool bearing in mind that choice may be influenced by footnotes A, B, C, D, E, or F.

By Leo J. St. Clair, General Tool & Die Corp.

particles. This combination of alloys gives the material some remarkable qualities. In the first place, the hardness of Kut Kost at 1100 deg. F. is several points harder than at room temperature and at 1200 deg. F. its hardness is just a little below its room temperature hardness. In the second place, its hardness can be brought up to Rockwell 75 "C" by heat treatment.

Kut Kost is centrifugally cast at very high speed and hence is extremely dense and tough. The appearance of a fracture looks a good deal like the fracture of a properly hardened high speed steel, that is, a very close grain structure with a silver gray, velvety appearance. Due to its ability to take very severe interrupted cuts, its toughness at 61-63 Rockwell "C" appears to be about the same as 18-4-1 H.S.S. Its toughness at 65-67 hard appears to be superior to the cobalt high speed steel. At 72-75 hard, its toughness, apparently is greater than the cemented carbides.

The material is being supplied commercially in three grades, labeled V, X and XV. There is also a fourth grade, XX, but it will be sold only on a restricted basis for specific applications since the material is very hard and lacks toughness. The table shows the four grades, corresponding hardness and typical applications for them.

Table of Kut Kost Grades

Grade	Hardness Rockwell "C"	Application
V	61-63	Heavy roughing cuts on ferrous metals, 1/32 to 1/8 in. feed. Will take severe interrupted cuts on tough irons and steel.
X	65-67	Semi-finish and medium roughing cuts on ferrous materials, 0.010 to 1/32 in. feed. Heavy roughing cuts on non-ferrous materials; feed anything machine tool will stand.
XV	68-70	Finish cuts on ferrous metals and for general duty on non-ferrous materials.
XX	72-75	Very light cuts on ferrous and non-ferrous materials. Will be sold for specific applications only.

The only difference in the grades is in the Rockwell hardness since the composition is the same for all grades.

It is difficult to lay down rules governing speeds and feeds because the most efficient speeds and feeds depend upon many factors such as the material being cut, the depth of cut and the condition of the machine. A speed of about 60 to 70 per cent of that recommended for a carbide tool operating under good conditions is practical with these alloy tools. Increased feed of from two to four times that used by carbide tools is recommended due to the great toughness of the material as compared with carbide tools. In fact, the most efficient operation of this tool material takes place when the cut is generating a high heat due to its increase in hardness at the higher operating temperatures. Failure of Kut Kost tools will result from the improper choice of hardness or grade.

Kut Kost tools can be ground as easily as high speed steel tools and by the same abrasive wheels. It is recommended that there be "dubbing off" of the fine cutting edge on medium roughing work and a severe dubbing off of the cutting edge on heavy work. On severe or jump cuts, a 45-deg. land can be stoned on the cutting edge. The width of this land should be from 15 to 25 per cent of the feed per revolution being used.

Kut Kost in the annealed state is from 50 to 52 Rockwell "C" hard, and consequently cannot be machined. Apparently the boron carbide remains in permanent solution so that it is impossible to produce a material any softer. Because of the difficulty of casting the material, for the time being, only square and rectangular pieces are being cast. Round pieces will have to be ground from square pieces.

Due to the scarcity of alloying material, Kut Kost will be supplied as a solid bit only in the sizes up to ½ x ½ x 4 in. Larger size tool shanks will be supplied in tipped form, being brazed by a special process.

The Iron Age

Columbium a Decreaser of Temper Brittleness

COLUMBIUM, like molybdenum, decreases the temper-brittleness of special steels, according to a study by S. T. Kishkin, Russian scientist, reported in the U.S.S.R.'s *Bulletin of Academic Science*. The carbides of columbium and molybdenum are dissolved back into the solid solution only at very high temperatures (2200-2375 deg. F.), he pointed out. During hardening steel from normal temperatures the carbides of columbium and molybdenum (which absorbed some carbon) exist in the metal in that form in which they were present before hardening, *i.e.*, as relatively coarse particles. These carbide particles serve as centers of crystallization of the coarse carbide masses during tempering of steel and prevent appearance of new fine carbides which are the cause of temper-brittleness. The presence in γ-Fe of columbium and molybdenum carbides decreases the degree of super saturation of the solid solution with carbon after hardening and retards the separation of the fine special carbides (chromium, manganese, etc.).

The effect of manganese in processes causing temper-brittleness is connected not with its presence in the solid solution of α-Fe, but with the property of forming slightly soluble carbides. Hardening from 2375 deg. F. and tempering at 390-490 deg. F. for 2 hours does not decrease the impact resistance or increases it (owing to overheating) very little, as compared with hardening from normal temperatures with the same tempering. The slight decrease of the impact resistance observed in some cases (after hardening from 2375 deg. F. and a low tempering) is the smaller the more columbium is present in the steel. Columbium decreases the tendency of steel to overheat. Nickel steel containing no special carbide-forming elements has no tendency for temper-brittleness when hardened from either 1690 or 2280 deg. F. Nickel and silicon-nickel steels containing molybdenum or columbium are insensitive to temper-brittleness only when hardened from comparatively low temperatures at which the carbides of molybdenum and columbium cannot dissolve in the solid solution of γ-Fe. Nickel and silicon-nickel steels containing molybdenum or columbium possess temper-brittleness if the hardening temperature is sufficiently high for the carbides of molybdenum or columbium to dissolve in the solid solution.

Stretch-Forming Speeds

. . . The versatility of stretch-forming on double-acting hydraulic presses is now being proved in production. Some of the innovations designed to speed up production and ease the difficulty of stretching shallow contours are described in this article.

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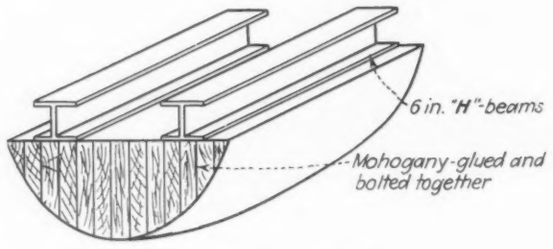
THE proper choice of a method to be used in making a part is as important as the selection of the proper material, especially when assurance of a more efficient production method is desired. The difficulties of sheet metal forming can best be minimized by analyzing the *obvious* troubles before they develop and the *obscure* troubles as they develop, from the standpoint of both the basic fundamentals and practical shop application.

Information on the practical shop application of "stretch-forming" is somewhat scanty because of the short time that this method has been in use by aircraft manufacturers. The industry as a whole has been quick to grasp worthwhile ideas and new methods; stretch-forming has been gaining in popularity and has recently been promoted from the "idea stage" to the "production stage." The importance of the development of simplified methods of forming troublesome contours is being universally appreciated. Development engineers have been devoting a good portion of their efforts not only to learning what can be done with present stretch-forming equipment, but also upon what could be accomplished with improved future equipment. They are rapidly reducing many "factors of ignorance" to dependable "factors of experience." Thus "knowing how" rather than "knowing about" forming technique enables the shop to meet the production schedules with interchangeable assemblies.

At Lockheed Aircraft Corp. the double-acting hydraulic press, in the absence of specially designed machinery, has been used to stretch-form work, as it permits the part to be held firmly along two edges as the punch forms the blank to the desired contour. The set-up is pictured diagrammatically in Fig. 1. The punch is attached to the main ram and there is no female or bottoming die. The place of the latter in supporting the hold-down plates is taken by the heavy rails shown at each side of the punch. Both the rails and the hold-down plates are smooth, the latter being held under heavy pressure by rods passing through the main ram up to the hold-down ram. Since most of the parts have deep contours in one direction and shallow contours in the other, the sheet is



DETAIL OF FORMING PUNCH

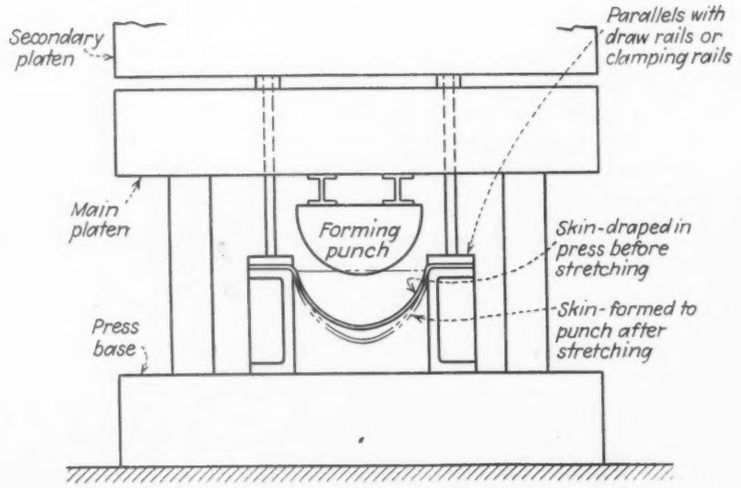


FIG. 1—Diagrammatic sketch of sheet metal stretching set-up on a double-acting hydraulic press as used in the Lockheed Aircraft Corp. plant.

Aircraft Production . . .

"draped" between the rails in such a way that when the punch descends, it stretches the material just enough to produce a permanent set, without of course rupturing the sheet. The lower rails have a generous radius on the inside edge, usually not less than 1 in.

Some of the fundamental principles of stretch-forming were discussed in an earlier article in THE IRON AGE (June 4, 1942) under the title, "Stretch Forming Contoured Sheet Metal Aircraft Parts," by T. H. Hazlett asd M. M. Rockwell, research engineers of Lockheed. (Together with three other articles by Lockheed research engineers, this article is available in reprint form under the title, "Making Aircraft Sheet Metal Parts," price 25c.). The current article concerns itself with refinements in the basic technique made either to speed up production or to eliminate difficulties.

By F. C. HOFFMAN

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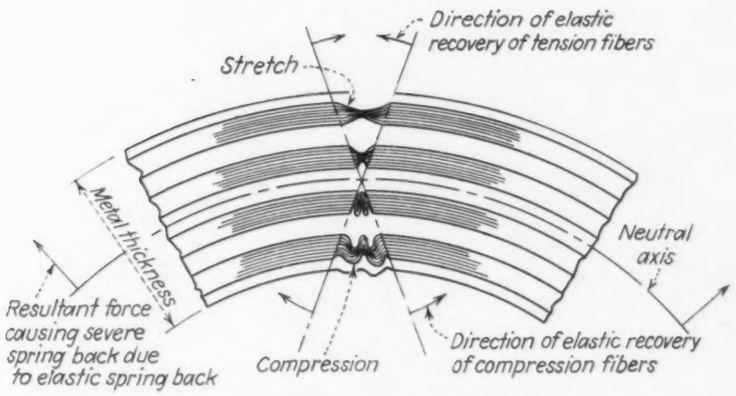


SPRING BACK RESULTING FROM ELASTIC RECOVERY WHEN FORMED BY BENDING METHOD

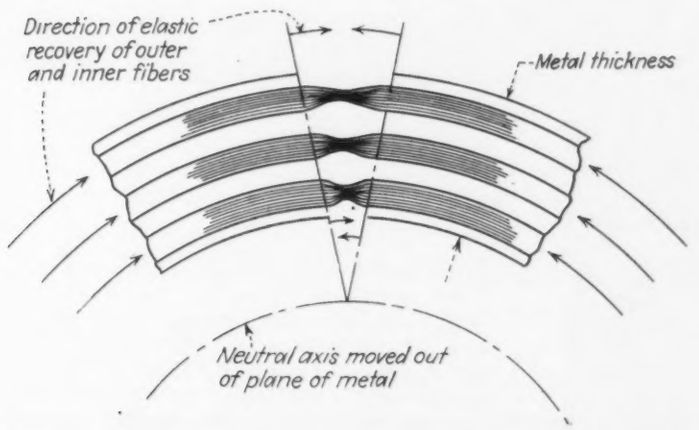


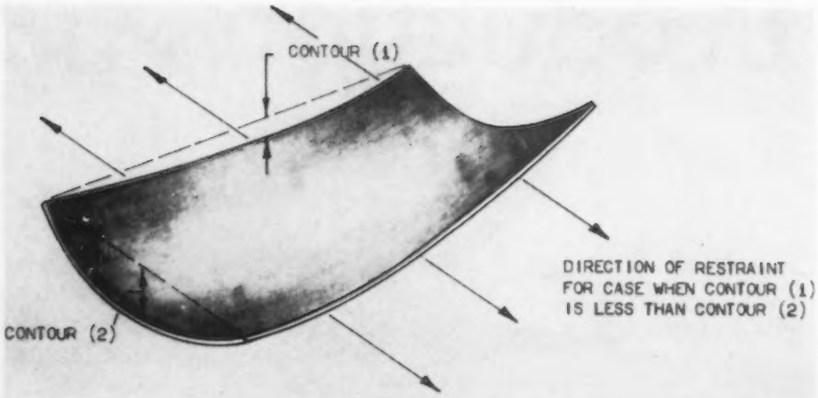
FIG. 2—In most instances elastic recovery or springback can be eliminated if all the fibers of the part are stretched into the plastic range during the forming operation.

Control of Springback

When stretch-forming is used to meet the best advantage, improved properties of the material may also appear evident. The control of springback has been a critical problem in the past, but with constantly improving technique, its troublesome features are being minimized and less development work required to produce satisfactory parts. Springback, in most cases, can be eliminated if all the fibers of the part are stretched into their plastic range during the forming operation. (See Fig. 2). Elastic recovery, the cause of springback, exists in stretched parts, but the recovery being in the plane of the metal and parallel with the curvature, does not cause distortion beyond usable limits.

The precaution to be observed in this method of operations is stated by Shanley* as follows:

"The critical feature about stretch-forming is the danger of exceeding the maximum allowable strain before all portions of the sheet have been stretched to contour. This problem becomes even more serious at the point of attachment of the sheet to the stretching device or press. Since operations are conducted in the plastic range, the tensile stress will

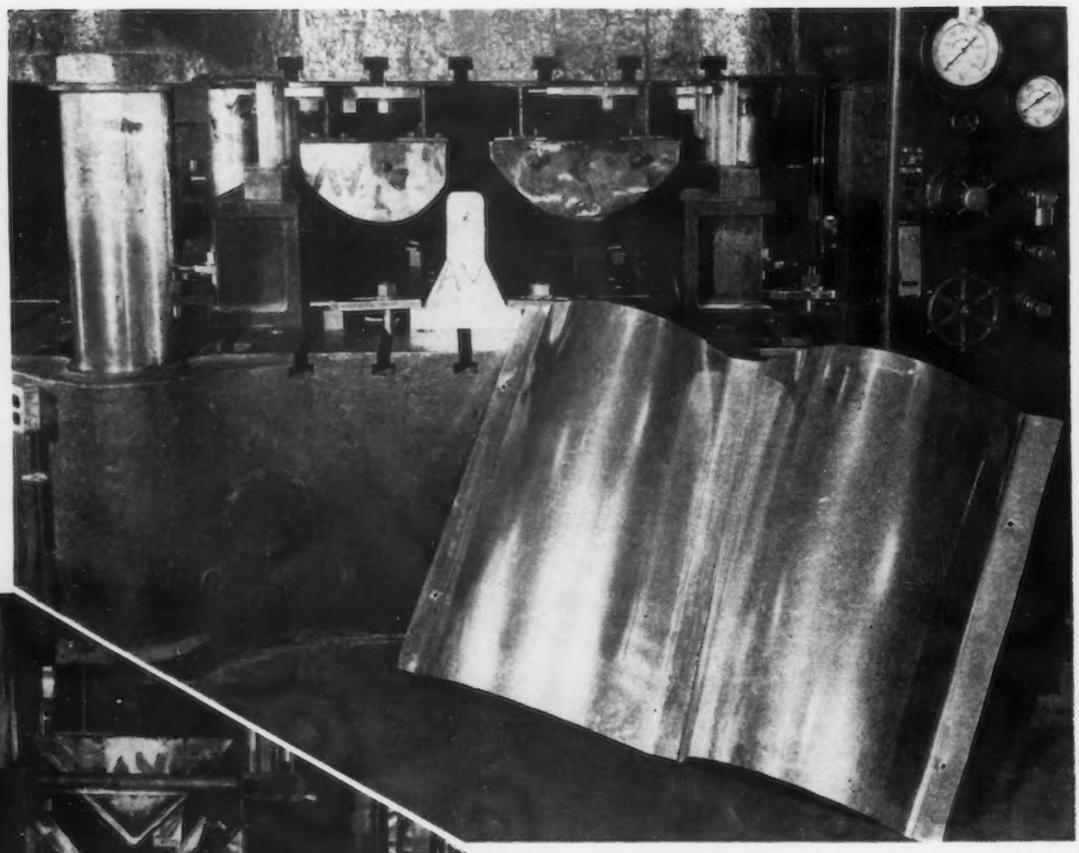


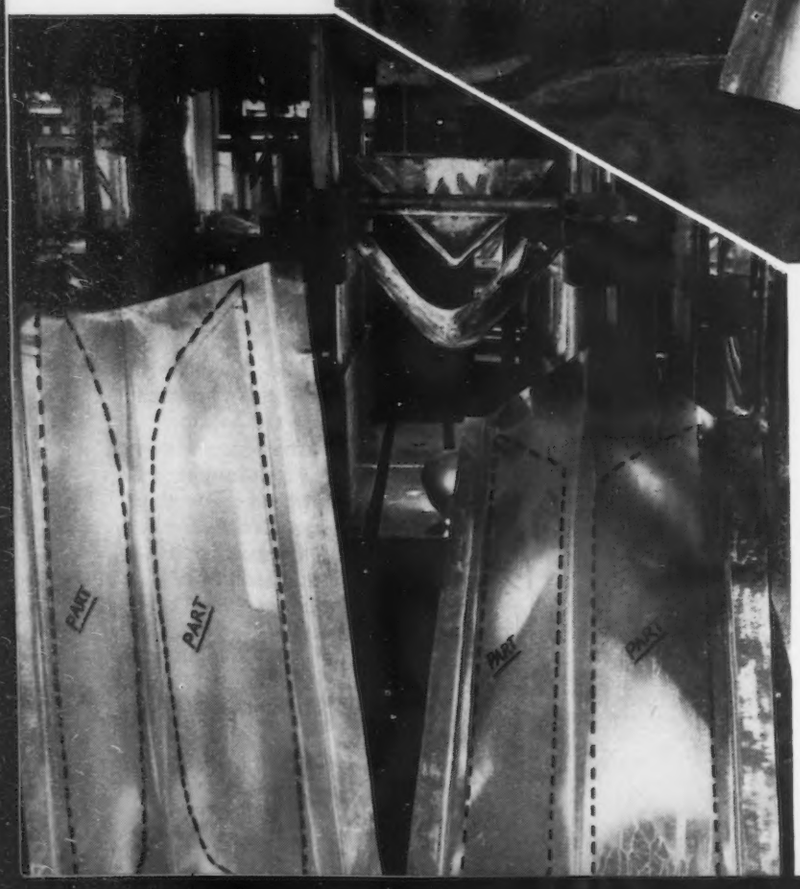
AT LEFT

FIG. 3—In the case of a double contoured part, it is best to restrain the sheet along the edges which have the smaller depth of contour, such as contour (1).

RIGHT

FIG. 4 — Two contoured fuselage skins were formed by one operation to speed up production and reduce waste. The punches are identical in shape but reverse in position, end for end, to allow the sheet to flow over the center rail more uniformly.





LEFT

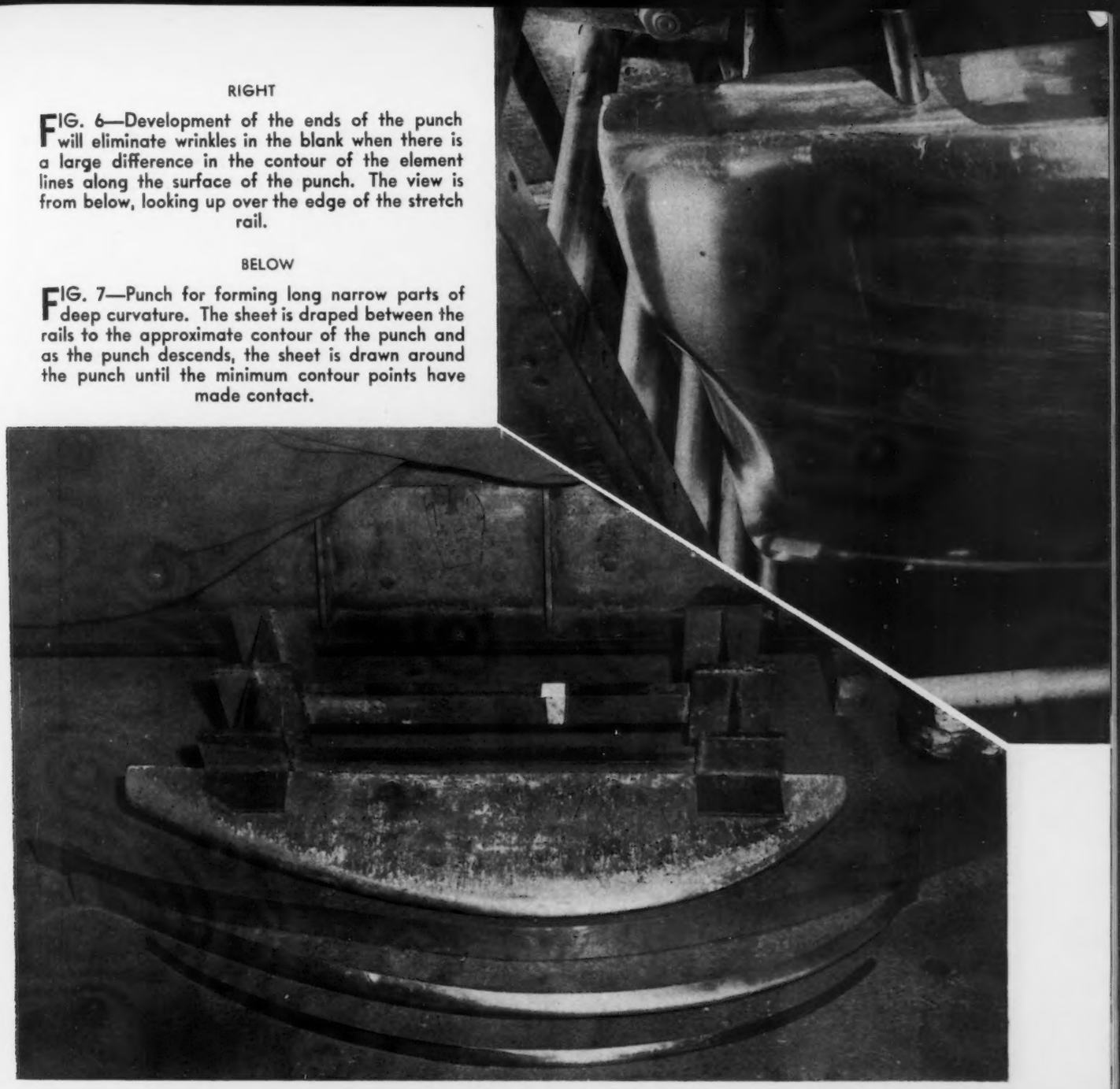
FIG. 5—The shallow contoured empennage skin panels were formed in pairs to minimize scrap as well as secure a more favorable forming angle with a V-type punch. This part could not be satisfactorily stretched as a single piece because the contour is too flat. The part was formed in two operations from 0.020 in. gage 24SO sheet. Before the second operation the partially formed sheet was heat treated (24SW) to limit the distortion.

RIGHT

FIG. 6—Development of the ends of the punch will eliminate wrinkles in the blank when there is a large difference in the contour of the element lines along the surface of the punch. The view is from below, looking up over the edge of the stretch rail.

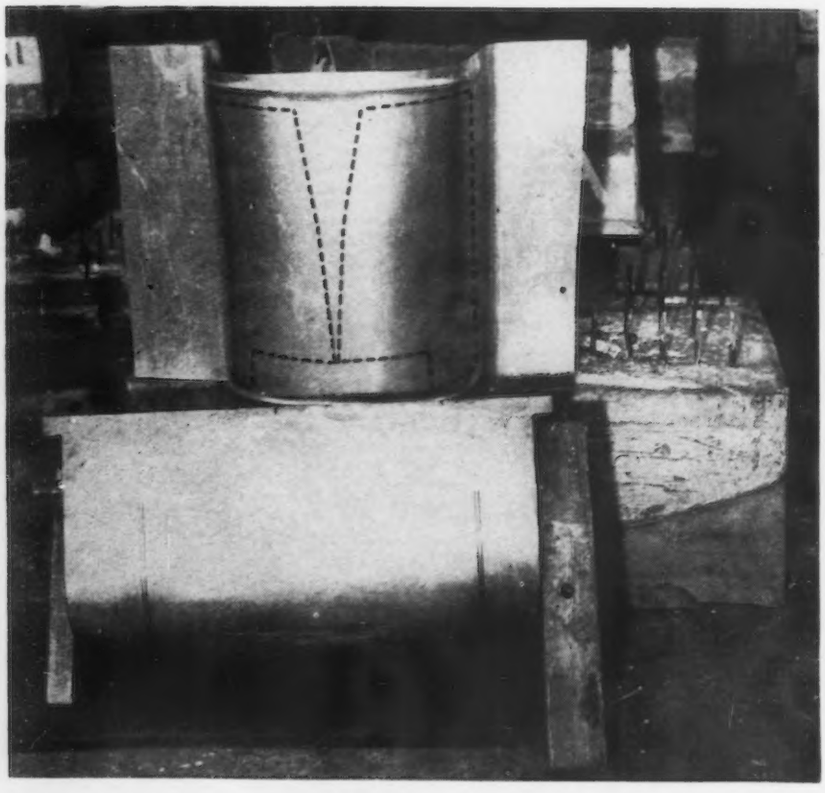
BELOW

FIG. 7—Punch for forming long narrow parts of deep curvature. The sheet is draped between the rails to the approximate contour of the punch and as the punch descends, the sheet is drawn around the punch until the minimum contour points have made contact.



RIGHT

FIG. 8—This stabilizer trailing edge is formed in two operations. The first operation, in which the part is approximately two-thirds fully formed, is done with the sheet in the 24SO condition and the second operation in the SW condition, which produces 24ST after ageing. The hinged clamp shown is used to keep the material tangent to the punch, reduce the tendency of the sheet to buckling and allow the forming of a deeper cross-section.



ABOVE

FIG. 9—Nacelle stretched skins —The 24ST Alclad material stretch-forms satisfactorily at different positions on the punch, resulting in acceptable parts of varied contours. Each sheet consists of a number of parts, which are later routed to size. There is a labor saving of 6¾ hr. per airplane.

° ° °

LEFT

FIG. 10 — The "saddle - back" punch shown was developed to form two fillets in one operation using 24ST Alclad. It was necessary to add the beads in order to prevent the edge of the sheet from drawing in excessively and forming wrinkles in the center of the sheet normal to the hold-down clamps.

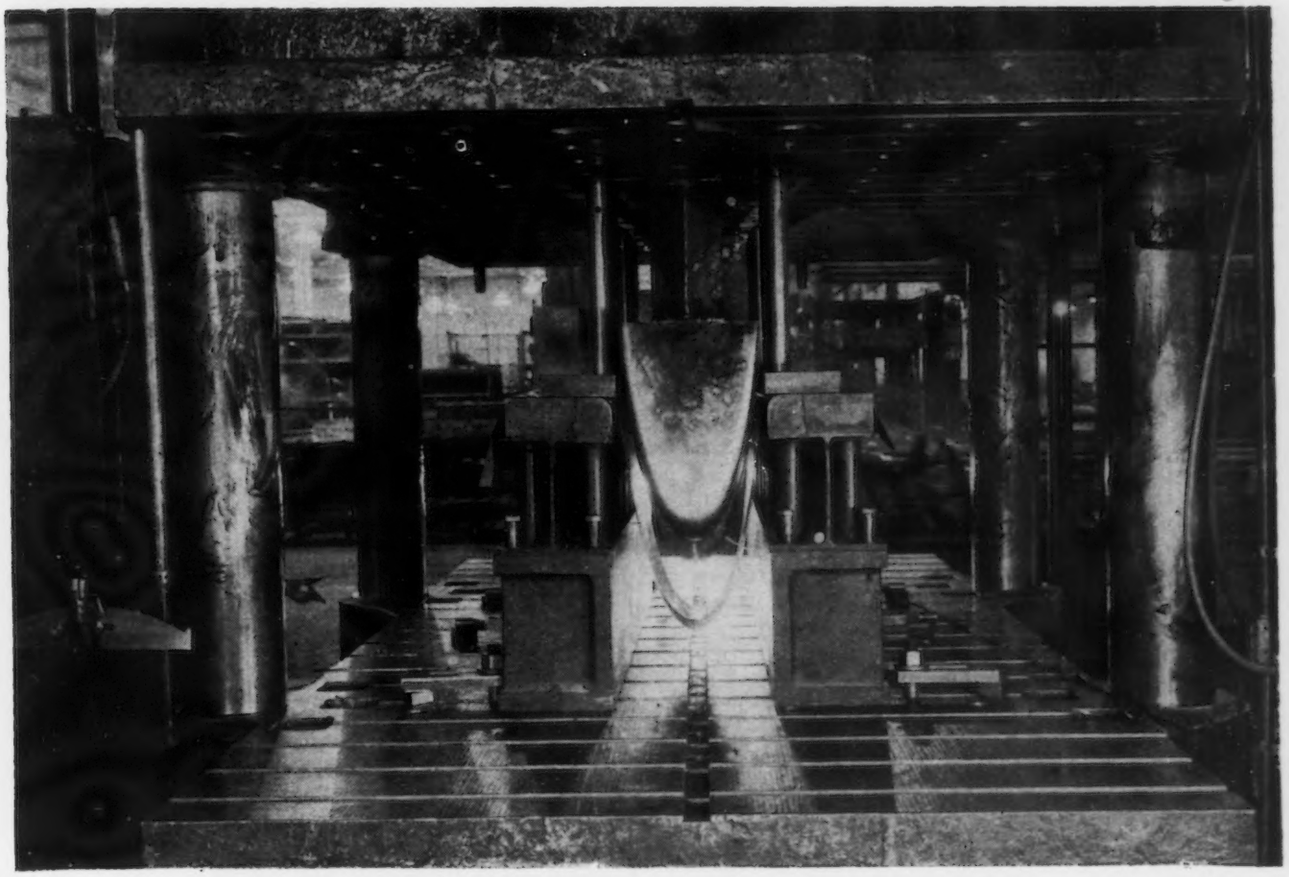


FIG. 11—This is the typical set-up used to stretch-form aircraft leading edges. This type of punch is designed to form reverse curvature parts and represents the maximum contour which can be attained without serious difficulty.

o o o

FIG. 12—These long narrow fillets are successfully stretched while the sheet is in the "ST" condition.

necessarily be high and will approach the ultimate stress as the limits of formability are approached."

* *"Elastic Theory as a Tool in Sheet Metal Forming Problems," F. R. Shanley. Paper presented at the annual meeting of the Institute of Aeronautical Sciences, Jan. 28 to 30, 1942.*

Our experiments have shown that the most efficient method of holding the sheet is to clamp it between two relatively smooth surfaces, using a high normal pressure for the hold-down plates to keep the sheet from slipping. This method can be used to an advantage in the double-acting presses shown in Fig. 1 and in many of the photographs. The use of a carefully polished and lubricated punch is essential to assure the most successful results through minimizing localized areas of stretching, thus maintaining uniform forming.

If the sheet was completely restrained on all sides and then stretched to double curvature, the maximum allowable elongation in any one direction would be less than that obtainable by a pure tensile coupon test. As a result of this effect, deeper forming with more complex curves can be obtained if only two edges of the blank are held and the remaining edges are left free. In the case of a double-contoured part, it has been found best to restrain the sheet along the edges which have the smaller depth of contour, Fig. 3.

Double Punch Set-Up

For parts that exhibit only a slight departure in form from a cylindrical or other line developed surface, the proper amount of "drape" to give the sheet before it is clamped in position is determined by trial or by calculation. It was this type of elementary stretching-forming operating that was described in THE IRON AGE article previously referred to. This type of work can be speeded up by forming two pieces at a time with a pair of punches as shown in Fig. 4. The punches are identical in shape but are reversed, end for end, because these fuselage skins are slightly conical in shape. The positioning of the punches is quite critical. They must be designed so that they contact the sheet simultaneously for the full length. If the stretch is more severe than shown, several stages should be

used, with an anneal between stages.

Forming two pieces at a time, using a V-shaped punch and no center rail, Fig. 5, has also enabled skin panels to be formed that could not satisfactorily be stretched as a single piece because the contour is too flat. When exceptionally flat compound surfaces are stretched, there is a tendency to overform the center of the palt. Aside from offsetting this tendency the die shown in Fig. 5 results in saving of material since both parts are formed with approximately the same amount of flash as previously was required for a single part. Such a V-shaped die is made of Kirksite and is cored out to reduce weight.

On many parts there is a large difference in the contour of the element lines along the surface of the punch. The blank will then wrinkle or "bunch" even though extreme precautions are taken. This condition can be eliminated by developing the end of the punch as shown in Fig. 6. The corners of the die are built up, thus compensating for the difference in element lines, and eliminating the wrinkles.

Stretching Narrow Parts

Before a punch is designed for a stretch-forming operation, it is analyzed from the standpoint of both transverse and longitudinal forming, the longitudinal contour being indicated in Fig. 3 as contour (1) and the transverse contour being indicated as contour (2). Long narrow parts of deep curvature are more successfully stretched longitudinally. A die for such work is shown in Fig. 7. The strip is draped between the rails to the approximate contour of the punch. Then as the punch descends, the sheet is drawn around the punch until the minimum contour points have made contact. A minimum of 1½ per cent permanent set is necessary to form an acceptable part.

A more difficult part of this shape is shown being stretch formed in Fig. 8. Two operations are required. In the first, the sheet is approximately two-thirds fully formed while the material is in the annealed condition (24S0). For the second operation, the hinged clamps shown are used to keep the material, now in the SW condition, tangent to the punch. These clamps grip the work by pressure of the set screws. Gripping the work this way reduces the tendency of the sheet to buckle and allows the forming of a deeper cross-section.

Multiple Forming

A typical example of a double curvature part formed transversely is the engine cowling and nacelle skins. Fig. 9 shows how this type of forming may be used with a resultant saving of thousands of dollars as well as thousands of man-hours. The parts were formerly made on a rope drop hammer from 24 SO aluminum alloy, followed by heat treatment, which distorted the part and necessitated hand rework by a crown roll. The number of parts that can be routed from one formed sheet can be seen from the outline of each section. A large number of parts can be made because the contour is so nearly constant that any slight variation encountered may be taken up at the skin splices. The savings in fabrication cost become readily evident when this multiple type of composite forming is employed.

Making "'Saddle-back" Sections

Longitudinal or transverse forming of "saddle-back" parts—those parts which have a reverse compound curvature, such as wing fillets and fairing—generally present a more serious problem for punch design. The additional time required to develop a satisfactory method for stretching this type of part is well justified, for the conventional type of rubber-platen forming generally used produces parts of inconsistent contour. Rubber forming usually requires that the part be formed in the annealed condition, followed by heat treatment, which adds more distortion. The forming of the part in the "ST" condition eliminates both subsequent heat treat and distortion. The punch shown in Fig. 10 was developed to form two fillets in

POWER for a global war. Radial aircraft engine output has been one of the brightest spots in the production picture. These precision-built brutes are being inspected prior to shipment to Russia and England.

one operation. It was necessary to add the beads in order to prevent the edge of the 24ST Alclad sheet from drawing in excessively and forming wrinkles in the center of the sheet normal to the hold-down clamps.

Fig. 11 shows another type of punch designed to form reverse curvature parts like leading edges of wings. The part shown represents the maximum contour that can be attained without serious difficulty. Excessive double curvature results in severe wrinkles in the bottom of the saddle-back. Fig. 12 shows another example of a reverse double curvature successfully form stretched while the sheet is in the "ST" condition. If specially designed clamp plates are used to restrain the ends of the sheet, the excessive flash shown in the photograph can be reduced.

Most of the punches illustrated were made from the zinc alloy, Kirksite. Plastic, concrete, plaster and hard wood also have been used successfully when these soft materials are covered with an armor of mild steel sheet. Various types of lubricants are used to decrease friction between the face of the punch and the material being stretched. It is essential to polish the face of the punches to reduce friction to a minimum.

Stretching Preformed Parts

Smaller stretch machines are generally used to contour parts that have been preformed on a press brake. Sheet metal parts having long narrow sections, such as J-sections, hat sections, and angles are formed on the small machine shown in Fig. 13. Clamp-blocks with various types of jaws are designed to fit on the ends of the preformed section when used in these stretch machines. It is important in this type of stretching that the clamp-blocks rotate in such a manner that the clamp center line remains tangent to the contour of the form block, so that a bending moment will not cause the formed part to tear itself free at the clamp during the stretching operation. As the punch raises, it contacts the clamp arms, tilting the clamps backward and increasing the distance between the clamping points. Without this action, the mold lines of the part buckle and once this buckle has developed, it is difficult to remove by further stretching.

Fig. 14 shows a small experimental type of forming machine that should be very acceptable for applications where the part is rolled to approximate contour and then stretched. Friction between the part and form block prevents full forming in the area directly above the hydraulic jack. The side flanges do not pull down on the block, and the actual elongation varies considerably between the ends and the center of the part.

Both Alclad (24SO and 24ST) and ¼ hard stainless steel (AISI 302) have been tested on these two small machines.

The improvements in the technique of sheet metal forming have been made possible only through the close cooperation of the Lockheed structures research laboratory, the shop and the development engineer. With the present trend toward increased output for our national emergency, the exchange of ideas between aircraft industries will bring even faster and better developments in the future.

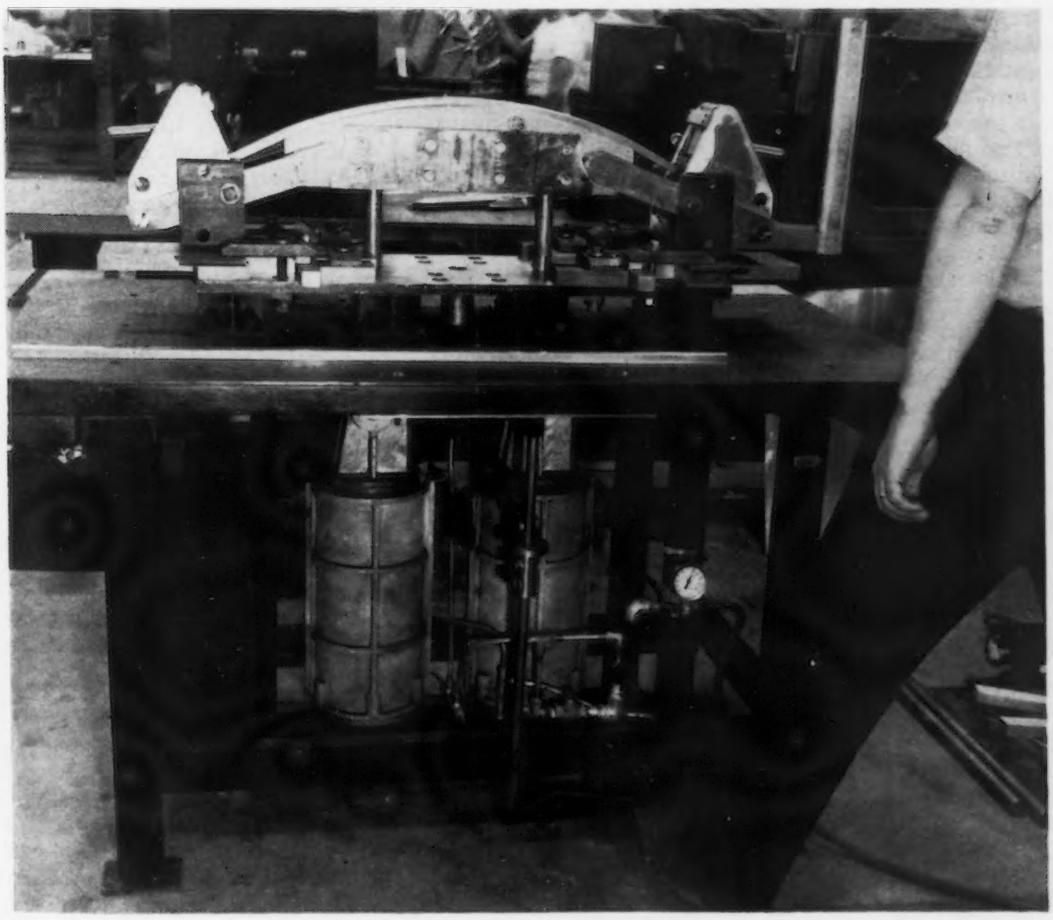


FIG. 13 — This small machine operates on a dual stretching principle when used to form hat section, V-section and similar preformed sections. Stretch occurs in two ways, first by the action of the punch and second by the lever action of the clamps themselves.

Plastic Assembly Jigs and Fixtures

. . . A quick drying plastic resin may be used in aircraft tooling processes. Engineering costs and time are greatly reduced, and large quantities of steel are saved.

By WILLIAM D. LEWIS
Tooling Superintendent, Timm Aircraft Corp., Van Nuys, Cal.

THE Timm Aircraft Corp. plant, which developed the first CAA approved plastic-bonded-plywood airplane, has also been a leader in the development of plastic tooling processes which have resulted in substantially reduced engineering costs and time, as well as important savings in steel. Essentially, the latter process consists of making a plaster mold from the mock-up of the part to be fabricated, then a plastic casting from the mold which becomes the backbone of the assembly jig.

Much of the success of the tooling process followed development of plastic material which cut curing time of the castings to a fraction of that formerly required and produced dies of desired physical characteristics. In cooperation with the technical staff of the plastic division of a southern California manufacturer, a plastic resin was created that required curing for hours only, instead of days.

From this material it is possible to produce jigs at lower cost and in less time than by former methods. The plastic also has the advantages of being easily worked with wood working equipment, and of sufficient impact strength to resist shop handling. The same material is also being widely used for forming dies. Duplicate tools can be made quickly and inexpensively for multiple operations. The solid plastic jigs have the distinct advantage of supplying a continuous surface over which the metal is formed, whereas the conventional jig gives support only at intervals of 12 in. to 14 in., which can cause wrinkles during assembly.

Now widely used in the Timm plant as assembly jigs on sheet metal sub-contracts held by the firm, the savings in time and materials are tremendous. For example, the drawings for a plastic jig for one cowl assembly required only 8 hr. and fabrication took 125 hr., including all metal work in gates and clamps. To design a conventional steel jig for the same part required 30 hr. drawing time, while fabrication consumed approximately 300 hr. And in addition to saving time, over 1000 lb. of steel were saved by the plastic jig.

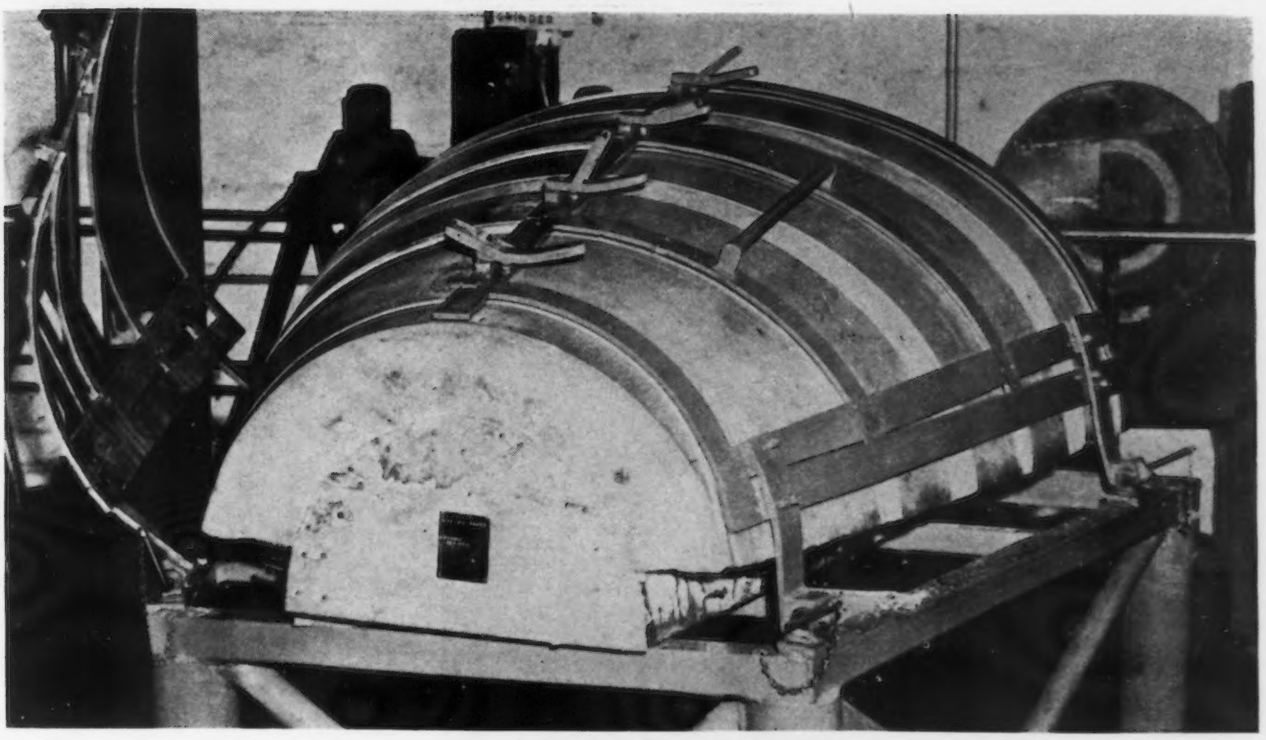
The same type of plastic material is applicable for drill jigs, formed router blocks, shaping blocks, checking fixtures, punch jigs, saw jigs and forming dies—in practically any jig involving contours.

Trim jigs, for instance, can be made as an exact counterpart of the stamping die, and with the addition of a gate becomes an infallible trim jig. This eliminates the time necessary to make templates, by forming the jig direct from the master part. The sides of the master part are built up to allow for proper thickness of the plastic and cast directly to the part. Since this gives an exact reproduction it eliminates machining and fitting.

As the resultant physical properties of the plastic casting are determined by the formula as well as the mixing, experiments were conducted to establish certain standards. The character of the casting can be varied to some degree by altering the amount and type of filler and special formulas have been worked out for specific purposes. However, a standard has been set up that is found acceptable for most plastic tooling. This is an acid-setting phenol formaldehyde composition, thermo-setting from liquid form. The mix formula is:

Resin, 67 per cent by weight.
Catalyst, 8 per cent by weight.
Filler, 25 per cent by weight (W.S.F.).

The filler is finely ground walnut shell flour. The ingredients are first carefully weighed. The acid catalyst is added to the resin slowly and carefully mixed. Then



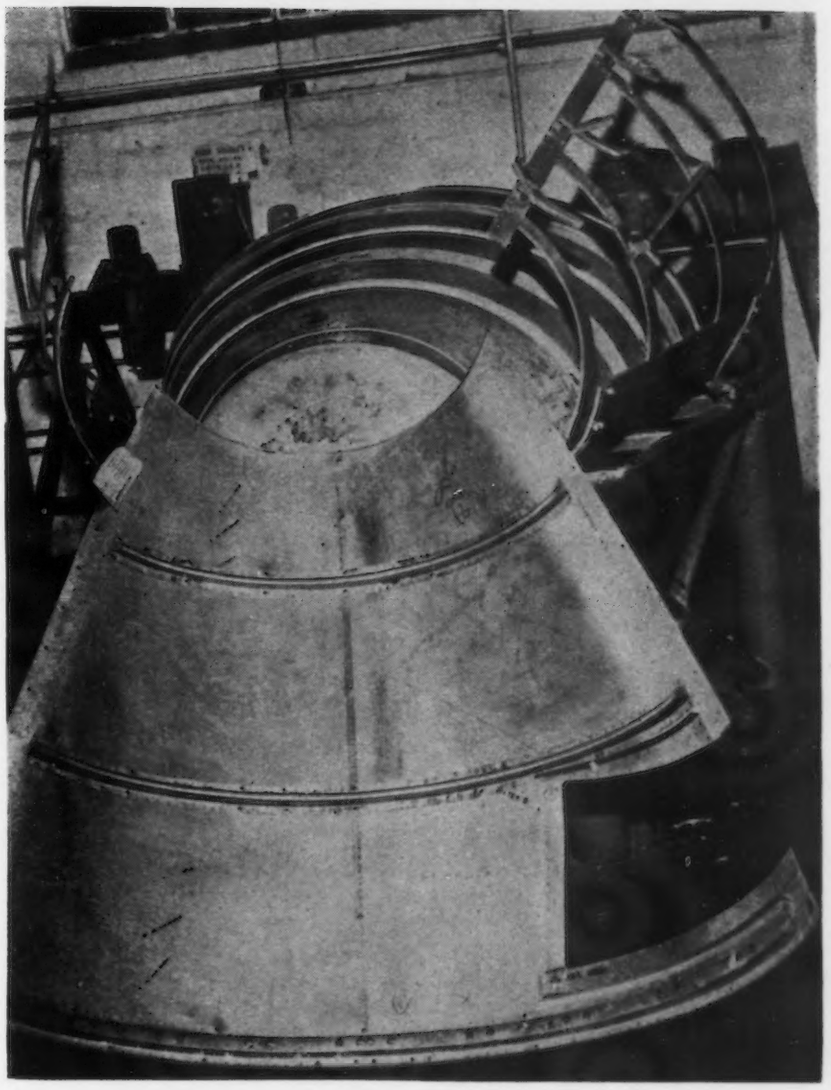
ABOVE

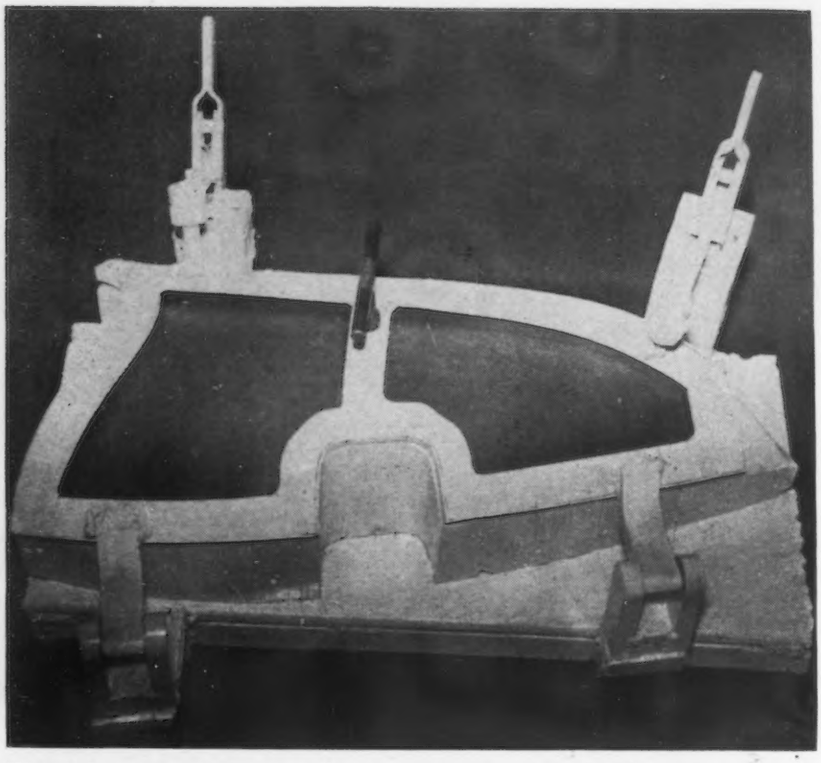
A COMPLETED plastic type assembly jig. Note the wooden core which is used to economize on plastic material. Special attention should be given to the wooden core to allow for the core's expansion and contraction due to the inconsistency of the moisture content of the air surrounding the jig.

■ ■ ■

AT RIGHT

THE finished cowl assembly is shown removed from the assembly jig, with the jig opened. Note recesses in plastic portion of jig to receive "hat" section stampings. These recesses were cast in the plastic directly from the plaster cast of the original mock-up of the nacelle assembly.





THIS is a typical trim jig. The plastic portion of the jig is an exact reverse poured off the die which makes the stamping that is to be trimmed in this jig. By the simple construction of a gate, a trim jig of infallible accuracy is obtained.

o o o

HERE is a plaster cast after it has been cured in the oven and given the proper treatment with four coats of lacquer.

the walnut shell flour is added and mixed. When ready to pour the plastic is a dark brown viscous liquid.

Care must be taken that the materials are mixed thoroughly and slowly, to avoid trapping excess air. All materials are handled and mixed in acid-resisting containers. Power mixers are used when large amounts of plastic material is needed for large castings. Bread mixers have proved successful for preparing this type of plastics.

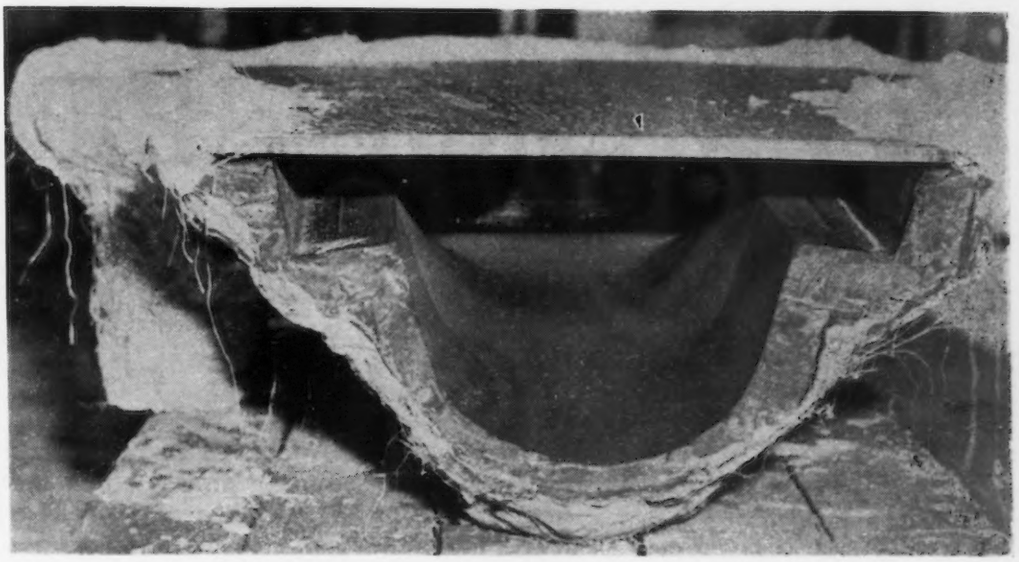
A jacketed kettle, to maintain uniform temperature, with an automatic mixer, is the usual equipment for handling certain types of thermo-plastics, because of the usual difficulty in maintaining the temperature at the desired level. However, this is not necessary with the phenolics in general use by Timm.

The thermo-setting plastic material is poured carefully into the previously lacquered plaster mold and care is taken to be sure that all parts are filled. The material is "puddled" to release excess air. Shrinkage is acccommodated by a retaining form extending above the master part. From this surplus, material is drawn into the mold as the plastic progressively solidifies.

When the plastic has been poured and puddled it is allowed to set and then placed in the oven for 2 to 8 hr. depending on the size and shape of the mold. The temperature is 150 deg. to 180 deg. F. When the casting is cured, it is removed from the oven, spot-sanded, if necessary, with fine paper and mounted on a suitable base.

The curing oven time depends on the size and shape of the plaster mold. Generally speaking, the time required is proportionate to thickness of the mold. The actual curing time, approximately 2 hr., does not include the time required for oven heat to pass through the plaster mold. Closed mold castings take longer to cure than open molds.

If a casting is pulled before it is completely cured it is difficult to put it back in the mold for further curing as the plaster is apt to get soft and pull out of shape. It is important to learn the required time for curing each piece. A decrease in the percentage of catalyst and increase in the amount of filler calls for a longer baking period. When the reaction between the catalyst and resin takes place, heat is created. In small castings, the ex-



A PLASTER cast after it has been covered and the cover board given the proper treatment with lacquer. This cast will be trussed up on end, in order to give a maximum of pressure for the plastic casting, especially in the thinner sections.

posed part may be cured before heat can penetrate the plaster to the bottom of the casting. If the bottom is fully cured, the top is overbaked.

As ready for finishing and mounting, the plastic is light brown, compact, tough and light in weight. It can be machined, turned, sawed, buffed, threaded and tapped on regular wood-working tools.

Plaster molds are extensively used at Timm for casting plastic jigs. The reverse plaster cast is made from the mockup. In size and thickness this depends on the size of the plastic cast to be taken. Hemp and steel reinforcement are used in the plaster cast.

The volume of plaster should never exceed the volume of the casting. Molds should always be made so they can be easily sprayed and then assembled and poured.

Better results are obtained if the plaster mold has had an opportunity to dry for several hours before spraying. The finished mold is painted with three or four coats of high grade lacquer. Each cast is a different color to insure complete coverage, and is allowed to dry thoroughly.

Wood patterns are made to allow for shrinkage which is uniform for each type and mix of material. The time of cure is also a factor in shrinkage.

For small, simple casts, open molds are used, while for larger castings closed molds are preferred. This is specially true if the casting has a large flat surface that would cure in advance of other portions of the cast.

All design for plastics should eliminate protruding angles and sharp corners and flanges. Radii should be as large as possible. Wall thicknesses should be great enough to prevent any possibility of warping.

Through this tooling process, thousands of man hours are being saved by Timm Aircraft Corp., in addition to reducing the amount of steel required in jigs. Thus two critical materials—manpower and steel—are made available to other manufacturers.

The Iron Age

Welding Solves Slab Mill Delay

A SERIOUS breakage in a side housing of an American Rolling Mill Co. slab mill drive created a repair problem which could be remedied only by welding unless a delay of 2½ months was to be experienced, according to a recent statement by the company. Since no standard method of heat control was available in the company shops, it was immediately foreseen that cooling strains might present a problem due to the number of welding hours required to mend this huge housing.

As a precaution against the weakening strains of too rapid cooling, the whole bottom of the housing was insulated with rock wool. No preheating was used. During the welding operation a workman followed-up the welder with an air hammer, peening the weld-bead as quickly as it was laid down. This had the effect of working the material which adjusted the internal strains and prevented it from becoming hard and brittle.

After welding, the entire housing was blanketed in rock wool which retained the heat created by welding and permitted a slow, uniform cooling to room temperature, an added precaution against cooling strains. Interesting statistics illustrating the size of the job include the fact that over two miles of welding rod, or 9100 rods weighing 691 lb., were used and that the housing was returned to service and rolling proceeded as usual in 339½ hr., or two weeks. This compares with the replacement estimate of 2½ months for a new housing.

Sintered, Forged a

By CLAUS G. GOETZEL

American Electro Metal Corp., Yonkers, N. Y.

THE rapidly increasing interest in industrial articles made from iron powder has created the demand for a thorough investigation of the powder metallurgy of iron and steel. Three different methods of molding powders to solid parts are known in the art, namely: cold pressing and sintering, often followed by a final sizing operation; hot pressing into final shape by combining the press and sintering operations; and metal working of cold pressed and sintered blanks.

The first method permits high production rates and close dimensional tolerances of the finished products, usually coupled with good anti-friction characteristics. However, the resulting material is never completely dense, of mediocre strength and of poor toughness and ductility. Hence the applications for this type of material are limited to those parts where a controllable degree of porosity is desired or not objectionable. Much information has been published in recent years on this subject, and the use in the automotive and electrical industries of pressed and sintered iron powders with and without carbon additions suggests their importance in the present war effort.

An urgent desire to improve strength and ductility of the powdered iron parts and thereby widen their industrial applications has led to hot pressing and subsequent working. In a previous article* certain experiments with iron powder compacts, hot pressed at elevated temperatures were discussed in detail. However, one of the greatest handicaps of the hot press method lies in the complicated and specialized expensive tools necessary for the molding operation. Therefore it is natural that attempts have been made to obtain improved properties by using equipment customary in the metal industry, such as continuous furnaces, forging presses or rolling mills.

*THE IRON AGE, *Sept. 4, 1941.*

. . . Interest continues to grow in experimentation with ferrous metal powder parts which are forged or rolled after pressing into blanks and preheating and sintering. Herein, mechanical data on sintered, rolled and forged iron contribute to the ever widening picture of the characteristics of ferrous metal powder objects.

Several recent publications have discussed successful experiments with ferrous metal powder parts which were forged or rolled after pressing into blanks and preheating or sintering. Herein, mechanical testing data of sintered, forged and rolled iron will be given as a contribution to the ever widening picture of the characteristics of ferrous metal powder objects.

Raw Material and Procedure

In this investigation attention was confined to soft iron powder compacts, free of combined carbon. Two types of iron powder were employed—sponge iron obtained by hydrogen reduction of mill scale, and electrolytic iron. The sponge iron analyzed 99 per cent Fe, and was of 100 mesh size, with approximately 30 per cent passing through a 325-mesh sieve. The electrolytic iron was soft annealed and analyzed 99.8 per cent Fe. Two grades were used, one coarse, all passing through 100 mesh, with 50 per cent through 325 mesh; and the other fine, all passing through 325 mesh.

The specimens to be tested were

FIG. 1—Tensile test bar of sintered iron after testing. Minus 100 mesh electroylfic iron powder was pressed at 50 tons per sq. in., sintered at 1200 deg. C. for 1 hr., repressed at 50 tons per sq. in., and resintered at 1200 deg. C. for 1 hr. Specimen was 97.2 per cent dense, had 33,000 lb. per sq. in. tensile strength and 58.7 per cent reduction in area.

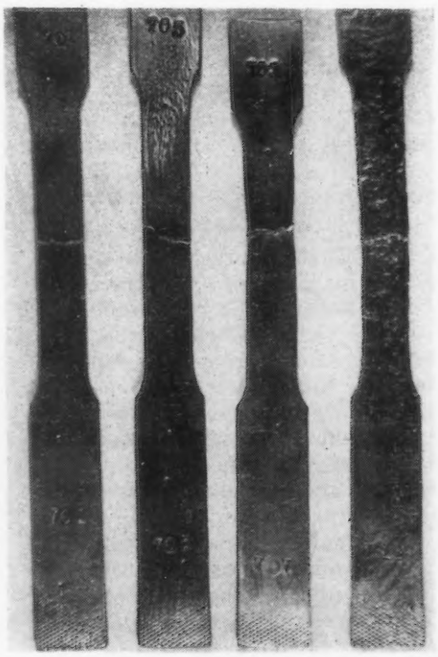


FIG. 2—Series of tensile test bars of sintered iron after testing. Raw material was electrolytic iron, —100 mesh. Specimen on left was pressed at 25 tons per sq. in., and sintered at 1200 deg. C. for 1 hr.; specimen, left center, was pressed at 50 tons per sq. in. and sintered at 1200 deg. C. for 1 hr.; specimen, right center, was pressed at 50 tons per sq. in., sintered at 1200 deg. C. for 1 hr. and repressed at 50 tons per sq. in.; specimen, right, was pressed at 50 tons per sq. in., sintered at 1200 deg. C. for 1 hr., repressed at 50 tons per sq. in., and resintered at 1200 deg. C. for 1 hr.

and Rolled Iron Powders

processed in three different ways. A first series of specimens was prepared by customary powder metallurgical operations, namely by pressing and sintering and in certain cases by a second pressing after sintering with or without a second sintering or annealing. Pressures of 25 and 50 tons per sq. in. were applied and compacts were molded into standard flat tensile test pieces of 2-in. gage length. The sintering temperature was kept within the range of from 1000 to 1300 deg. C. Taking into consideration the temperature used, sintering times were chosen with the object of obtaining complete consolidation and homogeneization of the structure. Sintering periods were in the order of from 1 to 2 hr. All heat treatments of these compacts were made in a cleaned hydrogen atmosphere.

A second series of tensile test pieces was obtained by cutting flat sections out of blanks made by pressing, sintering and hot forging. The iron powder was pressed at 25 tons per sq. in. into briquettes of 8-in. length, 2½-in. width and a height varying from ⅜ to 1 in. These briquettes were sintered at 1200 deg. C. for 1 hr., and, after cooling to room temperature, reheated to 1000 deg. C. prior to hot forging under a spring hammer. Forging was done without dies, in order to study any possible end defects on the blanks. The ingots were reduced either 25 per cent, 50 per cent or 75 per cent in height, the final thickness aproaching ¼ in. The heavily reduced ingots were annealed each time after the 25 and the 50 per cent reduction. Part of the plates were used as forged while others were subjected to a final anneal before machining out the test specimens. Each plate yielded three test pieces, a center one and two outer ones.

The third set of specimens consisted of tensile bars obtained in a fashion similar to that previously described, but from blanks cold rolled after pressing and sintering. Again ingots of 8 x 2½ in. area were pressed at 25 tons per sq. in. and sintered at 1200 deg. C. for 1 hr. The ingots were reduced in the rolling mill and were annealed after each 25 per cent reduction.

Both types of iron powder were used for the specimens of the first series, while only sponge iron was used in the second and third series. Triplicate specimens were made and tested in all but a few cases duplicates were used to study the effects of sintering procedure on sponge iron compacts. Here, tests were limited to ordinary tensile tests, while in all other cases density and hardness were measured in addition to a thorough investigation of the tensile properties, in-

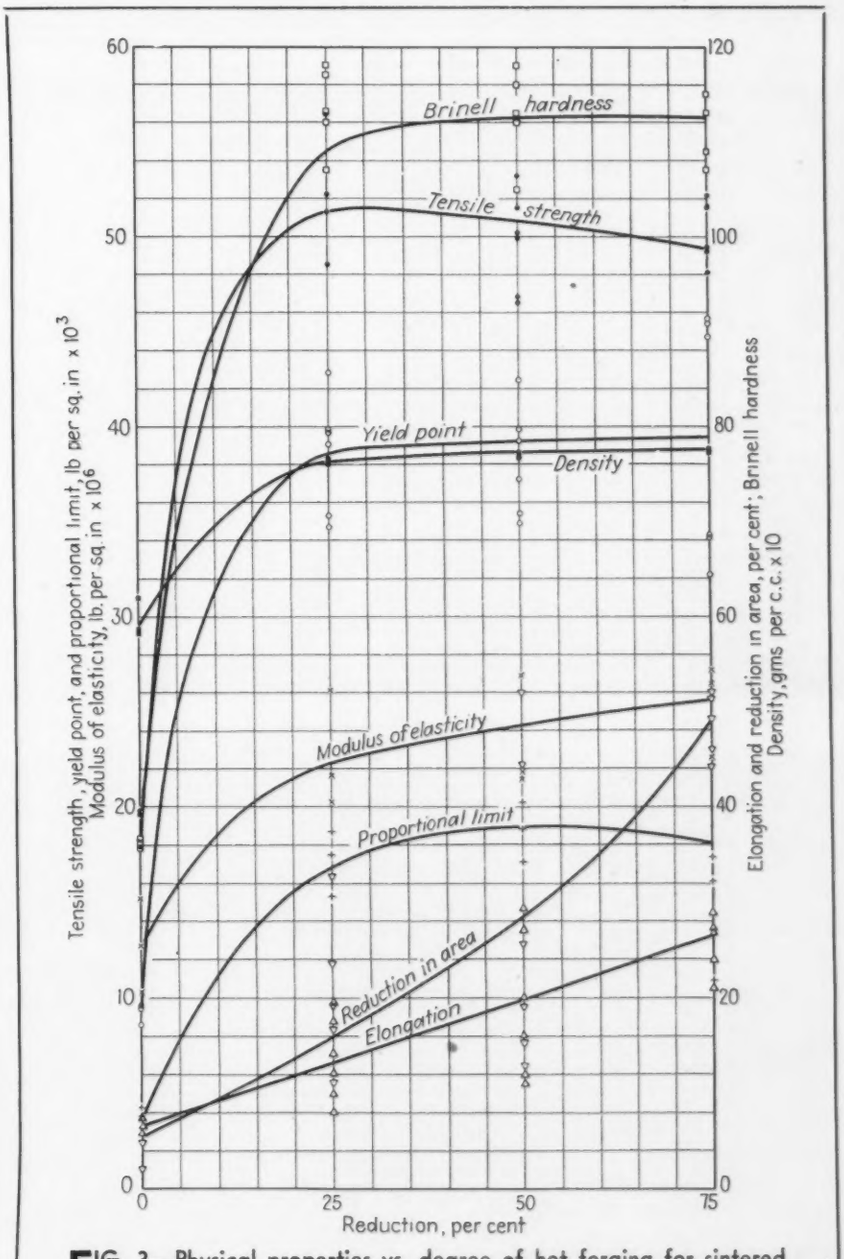


FIG. 3—Physical properties vs. degree of hot forging for sintered hydrogen-reduced iron.

cluding extensometer readings and the determination of the modulus of elasticity.

Sintered Iron

Physical properties of sintered hydrogen reduced sponge iron are given in Tables I and II, and similar data for electrolytic iron powder compacts are given in Tables III and IV. The density of sponge iron is 75 per cent of normal for low pressed compacts but can be improved to approximately 90 per cent by higher molding pressure and to about 96 to 97 per cent by a second press operation. These values are higher in the case of electrolytic iron compacts, especially in the singly processed materials. Coarse electrolytic iron compacts reach densities of approximately 98 per cent, after being twice pressed at 50 tons per sq. in. and twice sintered at 1200 deg. C. for 1 hr. Hardness values show a similar trend with singly processed material being abnormally soft, and compacts twice processed giving Brinell figures between 65 and 80. Materials tested after the second pressing showed higher hardness values due to their strained state, with sponge iron displaying hardness values above 100 Brinell.

Tensile data follow roughly the same course. For single processed material the proportional limit was found to be in the exceedingly low order of 4000 to 5000 lb. per sq. in., and a double processing could better these figures only slightly. Only the strained repressed compacts from electrolytic powder displayed substantially higher values. Yield points were markedly increased by the higher molding pressure, but not by double processing. Tensile strengths, aproximately half of normal for low pressed compacts, increased to values in the order of 30,000 lb. per sq. in. for higher pressed and double processed metal. Sponge iron compacts twice pressed and sintered show a distinct superiority both in yield point and ultimate strength.

PRACTICE, Practice, and more practice makes perfect. Here the Marines and Air Corps work together to coordinate operations for that smashing attack the victor must have.

Tensile data of 38,000 lb. per sq. in. for the hydrogen reduced sponge iron approaches standard vales for fused and annealed electrolytic iron. A similar trend is recognizable in the yield point and ultimate strength figures for the strained, repressed compacts. Average tensile values of 56,000 lb. per sq. in. for the sponge iron compacts compare with 48,000 lb. per sq. in. for the fine electrolytic powder compacts and 43,000 pounds per square inch for the coarse grade electrolytic iron.

Modulus of elasticity increases from approximately 40 per cent of normal in the case of low pressed

TABLE I

Tensile Properties of Sintered Hydrogen-Reduced Iron

History of Iron Powder Compacts		Yield Point, Lbs. Per Sq. In.	Tensile Strength, Lbs. Per Sq. In.	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in.	Sintered at 1000 deg. C., 2 hr.	 12,650	16,100 17,600	5.0* 6.0	2.1 4.2
	Sintered at 1150 deg. C., 1½ hr.	....	16,700 17,250	4.5* 5.5*	2.1 1.4
	Sintered at 1300 deg. C., 1 hr.	 14,200	20,500 20,300	6.0* 9.0	12.9 15.5
Compressed at 50 tons per sq. in.	Sintered at 1000 deg. C., 2 hr.	12,850 14,300	29,900 31,500	10.0 9.0*	7.7 7.5
	Sintered at 1150 deg. C., 1½ hr.	14,200 14,900	30,000 29,100	11.5 8.5*	11.5 8.3
	Sintered at 1300 deg. C., 1 hr.	15,100 16,700	30,200 31,500	10.5 9.5*	11.6 10.0
Compressed and repressed at 25 tons per sq. in.	Sintered and resintered at 1000 deg. C., 2 hr.	16,750 16,700	26,700 26,700	5.5* 7.5*	6.8 7.3
	Sintered and resintered at 1150 deg. C., 1½ hr.	18,400 17,450	34,900 36,500	16.5 20.0	17.0 19.2
	Sintered and resintered at at 1300 deg. C., 1 hr.	19,000 16,800	35,600 36,400	17.5 17.5	17.2 17.9
Compressed and repressed at 50 tons per sq. in.	Sintered and resintered at 1000 deg. C., 2 hr.	18,450 20,800	36,000 35,800	20.5 15.5	16.9 14.2
	Sintered and resintered at 1150 deg. C., 1½ hr.	19,750 19,700	35,900 35,400	21.5 15.5	21.3 16.3
	Sintered and resintered at 1300 deg. C., 1 hr.	21,200 21,500	33,400 34,500	14.0* 18.0	13.4 16.5
Electrolytic Iron, Fused and Annealed		10,000 to 20,000	35,000 to 40,000	40 to 60	70 to 90

* Fractured outside of gage length

compacts to a maximum of about 75 per cent of normal for twice processed material. The modulus of the repressed compacts is slightly below the optimum value for resintered material as must be expected in cold deformed metal. Modulus of elasticity data of the sponge iron compacts in their various stages are lower than figures obtained from the electrolytic powder compacts.

Elongation and reduction in area values also follow the general trend. They are as low as one-fourth of normal for low pressed compacts and improve slightly with higher pressures. They are again increased by a double pressing and sintering but with one exception, are not better than one-half of standard values for wrought iron. In one specimen a reduction in area figure of 58 per cent could be obtained, a figure most remarkable for a sintered metal. Unfortunately, fracturing occurred outside the gage length so that the elongation remained low. However, measuring the overall length of the tensile bar before and after testing showed an increase of more than 1 in., thus indicating a true elongation of over 50 per cent.

This particular tensile specimen underwent a considerable deformation during testing and its surface took on an appearance normally seen in non-ferrous ductile metals. Fig. 1 is a picture of this particular specimen, while Fig. 2 includes a group of tested tensile specimens

TABLE II

Tensile Properties of Sintered Hydrogen-Reduced Iron

History of Iron Powder Compacts	Density Gm.Per C. C.	Density vs. Iron, Per Cent	Brinell Hardness	Proportional Limit, Lb. Per Sq. In.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Modulus of Elasticity Lb. Per Sq. In. x 10^6	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in., sintered at 1200 deg. C., 1 hr.	6.19	78.6	36	4,200	8,600	17,900	12.7	6.5	7.6
	5.86	74.5	35.5	3,800	9,400	19,600	15.2	7.0	4.8
	5.82	74.0	36.5	3,600	9,600	19,800	10.3	6.0*	2.0
Compressed at 50 tons per sq. in., sintered at 1200 deg. C., 1 hr.	7.05	89.6	54	5,500	16,000	31,300	14.9	10.0*	10.7
	6.88	87.4	64	5,100	21,300	34,600	13.8	14.5	18.3
	6.93	88.0	57	5,900	17,400	29,300	14.3	11.0*	11.7
Compressed at 50 tons per sq. in., sintered at 1200 deg. C., 1 hr.; repressed at 50 tons per sq. in.; resintered at 1200 deg. C., 1 hr.	7.59	96.5	81	4,500	19,800	37,900	18.2	25.5	19.3
	7.61	96.7	76	4,600	20,500	38,100	18.6	26.0	20.9
	7.64	97.0	74	3,100	19,400	37,600	20.1	25.0	18.4
Compressed at 50 tons per sq. in., sintered at 1200 deg. C., 1 hr.; repressed at 50 tons per sq. in.	7.48	95.0	100	7,900	48,700	55,000	17.4	2.5	6.0
	7.60	96.6	111	6,800	53,500	58,500	16.7	2.0*	8.7
	7.53	95.6	96	5,200	52,500	54,700	19.9	1.5*	11.0
Electrolytic iron, fused and annealed	7.87		45 to 90		10,000 to 20,000	35,000 to 40,000	29.6 to 30.6	40 to 60	70 to 90

* Fractured outside of gage length.

TABLE III

Tensile Properties of Sintered Electrolytic Iron (Coarse Grade)

History of Iron Powder Compacts	Density Gm.Per C. C.	Density vs. Iron, Per Cent	Brinell Hardness	Proportional Limit, Lb. Per Sq. In.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Modulus of Elasticity Lb. Per Sq. In. x 10^6	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in., sintered at 1200 deg. C., 1 hr.	6.54	83.1	41	6,300	12,600	21,100	15.3	16.0	13.8
	6.74	85.6	39	5,300	11,700	19,800	16.8	12.0	11.7
	6.94	88.2	40	4,400	12,400	20,000	18.6	10.5*	9.8
Compressed at 50 tons per sq. in.; sintered at 1200 deg. C., 1 hr.	7.48	95.0	62	5,500	15,700	30,900	24.8	14.0*	24.5
	7.40	94.0	58	7,000	15,200	33,000	23.8	20.0	22.4
	7.63	96.9	61	5,400	16,000	30,900	21.7	15.0*	19.4
Compressed at 50 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; repressed at 50 tons per sq. in.; resintered at 1200 deg. C., 1 hr.	7.65	97.2	70	6,000	15,000	33,000	26.6	25.5*	58.7
	7.75	98.5	67	5,300	15,200	30,300	20.0	25.0	27.7
	7.75	98.5	67	5,800	15,700	30,500	23.6	27.5	32.0
Compressed at 50 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; repressed at 50 tons per sq. in.	7.61	96.7	79	18,100	40,100	43,100	18.1	10.0	28.4
	7.62	96.8	81	16,000	39,800	42,600	20.0	5.0	18.8
	7.55	96.0	83	16,000	40,400	43,000	19.6	7.5	20.0
Electrolytic iron, fused and annealed	7.87		45 to 90		10,000 to 20,000	35,000 to 40,000	29.6 to 30.6	40 to 60	70 to 90

* Fractured outside gage length.

made from coarse grade electrolytic powder in their various processing stages.

Table I permits a detailed study of the effects pressure and sintering temperature have on some of the tensile properties. In the low pressed bars the highest sintering temperature gives also the highest tensile and ductility values of the group. In the high pressed and sintered bars this tendency is less marked for yield point and ductility values, while there is no distinctive difference in the ultimate strength figures. In the group representing specimens twice pressed at low pressures and twice sintered, an improvement of all data is recognizable when sintering temperature is raised from 1000 deg. C. to 1150 deg. C. Sintering at 1300 degrees C. causes no important changes in these values. A similar increase in sintering temperature for specimens twice pressed at the higher pressure does not show any appreciable influence on the strength and ductility values.

Hot-Forged Iron

Effects of subsequent working on the properties of sintered iron can be seen in Table V, VI and VII and in the graphs of Figs. 3 and 4, where density, hardness and tensile properties as a function of the degree of reduction are given for the forged and rolled briquettes.

TABLE IV

Tensile Properties of Sintered Electrolytic Iron (Fine Grade)

History of Iron Powder Compacts	Density Gm.Per C. C.	Density vs. Iron, Per Cent	Brinell Hardness	Proportional Limit, Lb. Per Sq. In.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Modulus of Elasticity Lb. Per Sq. In. x 10^6	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.	6.65	84.5	43	4,300	14,400	23,900	16.3	12.5	11.0
	6.56	83.4	45	4,900	14,900	23,600	15.8	11.5*	10.3
	6.79	86.3	44	5,100	13,700	24,100	15.2	12.0	10.9
Compressed at 50 tons per sq. in.; sintered at 1200 deg. C., 1 hr.	7.25	92.1	63	5,600	16,000	29,500	24.1	16.0*	23.5
	7.41	94.2	64	4,900	16,200	31,200	22.8	12.0*	22.8
	7.23	91.9	59	4,400	16,500	30,900	25.4	10.5*	20.7
Compressed at 50 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; repressed at 50 tons per sq. in.; resintered at 1200 deg. C., 1 hr.	7.69	97.7	64	3,600	15,000	31,400	26.4	13.5*	22.5
	7.62	96.8	66	5,300	14,800	31,100	26.4	16.5	25.2
	7.65	97.2	67	4,400	15,000	30,200	24.1	17.5	28.4
Compressed at 50 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; repressed at 50 tons per sq. in.	7.48	95.0	90	18,600	43,400	46,200	18.6	5.5	24.7
	7.54	95.8	99	14,000	45,700	51,100	23.3	5.0	28.0
	7.57	96.2	87	9,000	44,000	47,600	20.3	5.0	16.6
Electrolytic iron, fused and annealed	7.87		45 to 90		10,000 to 20,000	35,000 to 40,000	29.6 to 30.6	40 to 60	70 to 90

* Fracture outside of gage length.

TABLE V

Tensile Properties of Sintered Hydrogen-Reduced Iron After Forging

History of Iron Powder Compacts	Density Gm.Per C. C.	Density vs. Iron, Per Cent	Brinell Hardness	Proportional Limit, Lb. Per Sq. In.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Modulus of Elasticity Lb. Per Sq. In. x 10^6	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 25 per cent reduced by hot forging at 1000 deg. C.	7.65	97.2	107	18,700	39,800	52,300	20.3	12.0*	16.7
	7.61	96.7	107	15,300	42,800	56,400	21.65	19.5	32.7
	7.60	96.6	112	17,500	39,700	48,600	26.1	8.0*	11.1
	....	....	113	.....	34,700	48,500	....	10.0	12.1
	....	....	117	.....	39,000	52,200	....	17.5	23.6
	....	....	118	.....	35,300	51,300	....	14.0	19.1
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 50 per cent reduced by hot forging at 1000 deg. C.	7.66	97.4	116	17,100	37,200	46,500	21.5	11.0*	12.7
	7.73	98.2	118	18,800	42,400	51,500	21.8	29.5	52.0
	7.66	97.4	113	20,200	39,200	46,800	26.9	12.0*	15.7
	....	....	100	.....	34,900	49,900	....	16.0	19.0
	....	....	111	.....	39,800	53,200	....	27.0	44.2
	....	....	105	.....	35,400	50,200	....	20.0	25.2
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 75 per cent reduced by hot forging at 1000 deg. C.	7.74	98.4	115	16,100	45,400	49,500	22.6	27.5	49.1
	7.76	98.6	115	17,400	45,700	52,200	26.45	21.5*	44.1
	7.77	98.8	113	10,900	44,700	51,600	27.2	24.0	45.7
	....	....	109	.....	34,300	48,100	....	27.0	52.0
	....	....	107	.....	34,200	49,300	....	27.5	54.5
	....	....	109	.....	32,200	49,200	....	29.0	51.1

* Fractured outside of gage length.

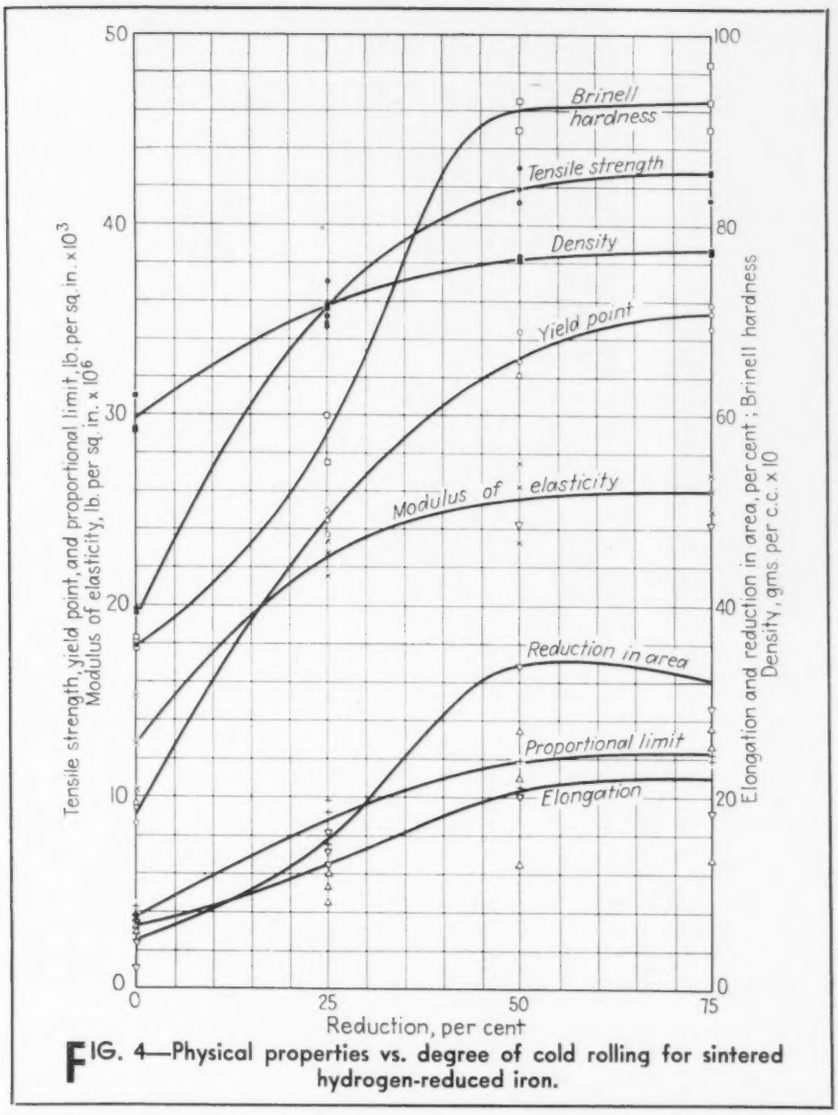


FIG. 4—Physical properties vs. degree of cold rolling for sintered hydrogen-reduced iron.

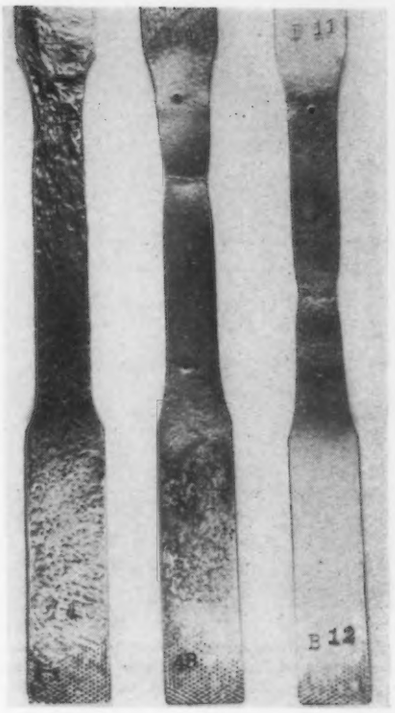


FIG. 5—Group of tensile test bars of sintered, forged or rolled iron after testing. (Left) Electrolytic iron, —100 mesh, pressed and repressed at 50 tons per sq. in., and sintered and resintered at 1200 deg. C. for 1 hr. (Center) Hydrogen reduced sponge iron, —100 mesh, pressed at 25 tons per sq. in., sintered at 1200 deg. C. and reduced 50 per cent by hot forging. (Right) Hydrogen reduced sponge iron, —100 mesh, pressed at 25 tons per sq. in., sintered at 1200 deg. C. and reduced 50 per cent by cold rolling; annealed at 1000 deg. C.

In Table V and Fig. 3 the data refer to the tests of as forged material. Density increases to 97 per cent of normal for 25 per cent reduction and approaches asymptotically the normal values with higher degrees of forging. Hardness values show a similar tendency to increase considerably after an initial hot deformation and approach practically constant values in the order of 110 Brinell for material reduced 25 per cent or more. Proportional limit, yield point and ultimate strength follow the same trend, and plotted versus the degree of reduction, show concave curves, with steepest slope during the initial stages of reduction. A slight drop in tensile strength values for the highest degree of reduction tested may be attributed to the beginning of fatiguing and overstraining of the boundary areas, and possibly could have been avoided by a long-time annealing. Yield point and tensile strength values obtained by forging average 38,000 and 50,000 lb. per sq. in., respectively, and are comparable with carbon-free wrought iron. However, the modulus of elasticity remains considerably below normal, in no case exceeding 90 per cent of the standard value. Elongation and reduction in area are also improved by hot forging, but remain short of standard. The convex shape of the curves indicates a possibility that these ductility values can be brought close to normal if the forging reduction exceeds the 75 per cent limit of this investigation, and if the material is completely released of all stresses by long-time intermediate anneals.

The importance of such annealing can be seen from the data of Table VI. A final anneal of the forgings at 1000 deg. C. for 1 hr. has lowered the hardness some 20 Brinell units. While yield point and ultimate strength figures have practically remained at the same high level, elongation and reduction in area have increased to peak values of 35 per cent and 60 per cent respectively for a forging reduction of 50 per cent.

Cold Rolled Iron

In Table VII and Fig. 4 similar data are given for cold rolled and annealed material. The increase of density and hardness with the degree of reduction is less steep than for forged metal, and the maximum values do not exceed 43,000 lb. per sq. in. Modulus of elasticity data match those for hot worked metal, but the highest elongation and reduction in area figures again are slightly below the maximum values found in forged material.

Part of the metal reduced 75 per cent by cold rolling was tested without the final anneal, and Brinell figures of approximately 120, yield points averaging 50,000 lb. per sq. in. and ultimate strength values up to 63,000 lb. per sq. in. give evidence of the severe cold deformation to which the metal was subjected.

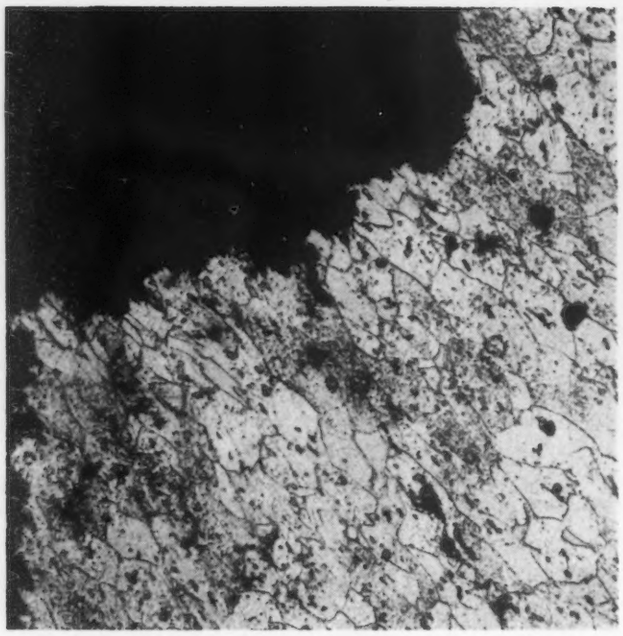


FIG. 6—Microstructure near the fracture of annealed tensile bar hot forged 25 per cent after pressing and sintering. Grains are elongated, and correspond to ASTM grain size No. 7. At 300 diameters.

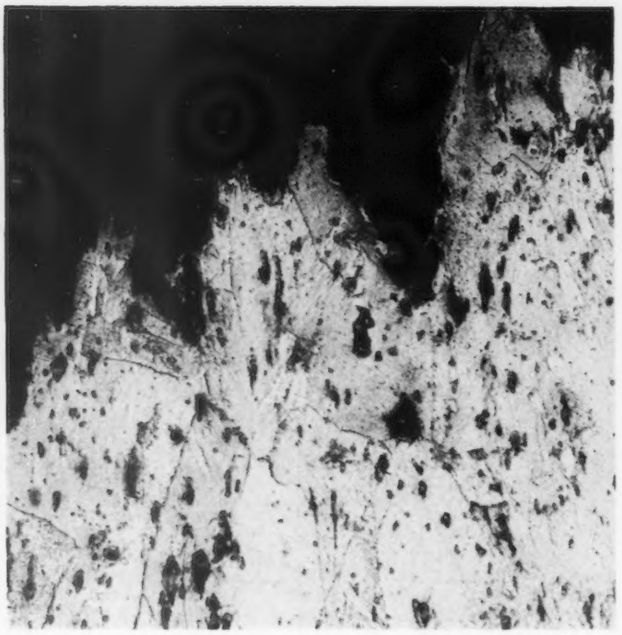


FIG. 7—Microstructure near the fracture of annealed tensile bar cold-rolled 75 per cent after pressing and sintering. Grains are elongated, correspond to ASTM grain size No. 3. At 200 diameters.

From the foregoing data the consolidating effect of the subsequent working procedure becomes apparent. All properties investigated show marked improvements, and either reach or approach normal values. This remarkable change in the material is also borne out by certain differences on the surface of the tested bars. Sintered specimens displayed either smooth or uniformly wrinkled surfaces over the entire gage length, much like tensile bars of cast iron or copper (Fig. 2). Contraction at the fracture, a criterion for high ductility in ferrous metals, is hardly noticeable in sintered iron, but becomes distinct as soon as hot or cold work is applied. In Fig. 5 a group of tested bars is shown, with the most ductile sintered bar placed next to a forged and a cold rolled and annealed specimen. The contraction at the fracture of the two worked bars is apparent, although not as distinct as in a standard test piece of wrought iron. The overall surface appearance of the worked tensile specimens was always smoother than in the case of sintered metals of similar elongation.

This phenomenon must be con-

FIG. 8—Microstructure near the fracture of sintered iron tensile specimen, pressed at 25 tons per sq. in. from electrolytic powder and sintered at 1200 deg. C. for 1 hr. Structure is porous and grains are elongated, correspond to ASTM grain size No. 5. At 300 diameters.

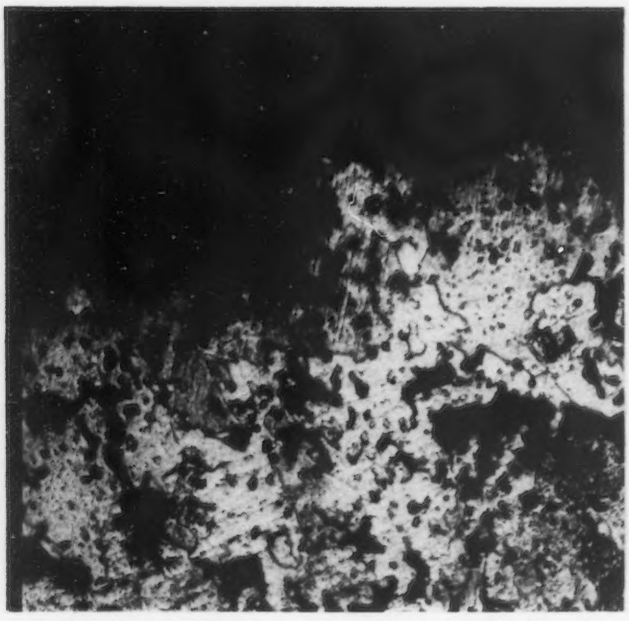
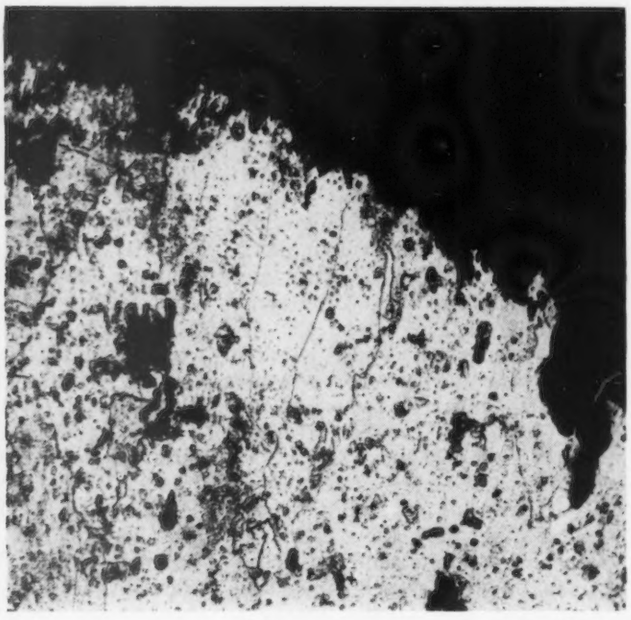


FIG. 9—Microstructure near the fracture of sintered iron tensile specimen, pressed at 50 tons per sq. in. from electrolytic powder and sintered at 1200 deg. C. for 1 hr. Structure is porous and grains are elongated, correspond to ASTM grain size No. 3. At 200 diameters.



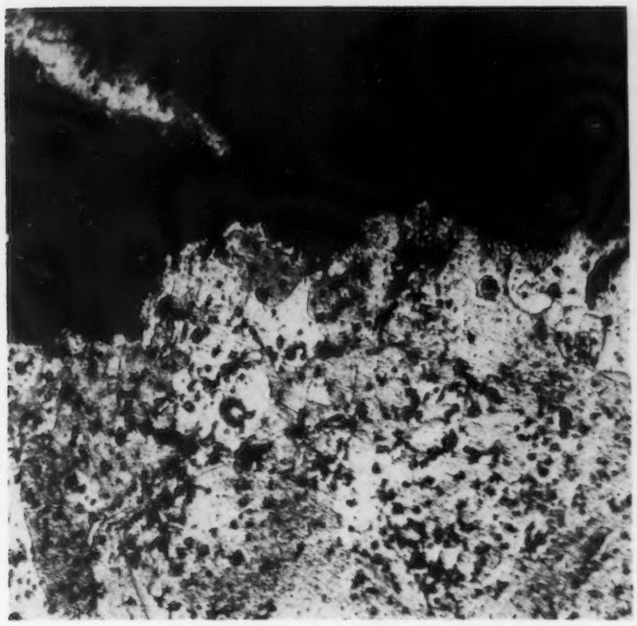


FIG. 10—Microstructure near the fracture of sintered iron tensile specimen, pressed at 50 tons per sq. in. from electrolytic powder, sintered at 1200 deg. C. for 1 hr. and repressed at 50 tons per sq. in. Structure is porous and grains are elongated, correspond to ASTM grain size No. 5. At 300 diameters.

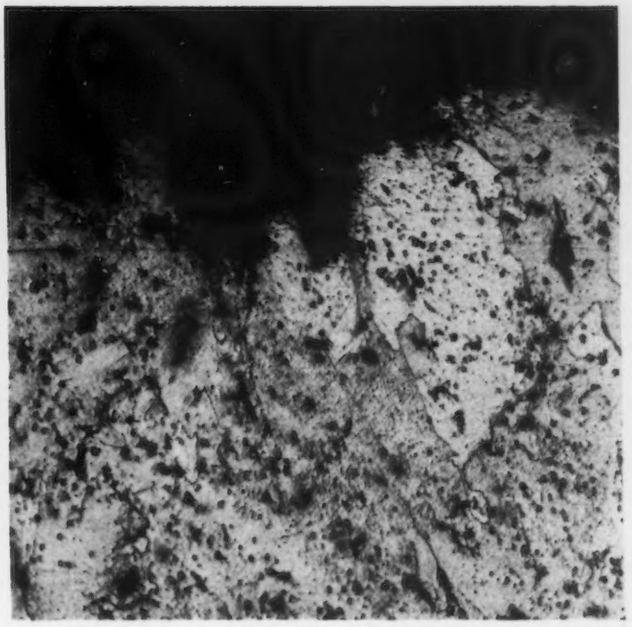


FIG. 11—Microstructure near the fracture of sintered iron tensile specimen, pressed and repressed at 50 tons per sq. in. from electrolytic powder and sintered and resintered at 1200 deg. C. for 1 hr. Structure is porous and grains are elongated, correspond to ASTM grain size No. 3. At 200 diameters.

sidered together with the results of a study of the fractures. Both the hot forged and the cold rolled and annealed iron bars displayed transcrystalline fractures, as can be clearly seen in the photomicrographs in Figs. 6 and 7, where grain boundaries frequently run close and parallel to the planes of rupture. On the other hand it was not possible to make a definite determination of the character of the fracture of the sintered material. The apparent lack of microscopic evidence of a transcrystalline fracture, even at high magnification, indicates a predominantly intercrystalline fracture for the sintered iron compacts (Figs. 8 to 11).

A close study of the data for the forged and rolled material discloses a definite variation in data for each category. Usually the second specimen shows peak values while the data for the first and third bars taper off some 5 to 10 per cent for the strength values and sometimes up to 50 per cent for the ductility values. This peculiar behavior must be attributed to the end effects during rolling or hot forging without die. Although the frequent intermediate anneal prevented severe contamination of the edges, the outside zones were more deformed and strained than the sufficiently reinforced center portions of the billets. In Fig. 12, a group of three adjacent specimens, reduced 75 per cent by cold rolling is shown after testing. The effects of the overstrained longitudinal edges of the original plate are plainly visible.

Conclusions

Variations in processing steps in making molded and sintered metals permit control of mechanical properties to a great extent. In this investigation, attempts have been made to improve the density, hardness and tensile properties by properly choosing and controlling certain basic factors. Effects of the type of powder have been studied, and different molding and testing methods have been used. Special attention has been paid to consolidating of the sintered metal by hot and cold working.

Sintered iron may develop prop-

TABLE VI

Tensile Properties of Sintered Hydrogen-Reduced Iron After Forging and Annealing

History of Iron Powder Compacts	Brinell Hardness	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 25 per cent reduced by hot forging at 1000 deg. C., annealed at 950 deg. C. 1 hour.	102	30,600	46,900	18.0*	29.3
	107	35,400	51,400	27.5	45.7
	93	35,400	48,400	21.0	43.2
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C. 1 hour; 50 per cent reduced by hot forging at 1000 deg. C.; annealed at 950 deg. C. 1 hr.	88	31,500	46,800	23.0*	35.5
	95	34,100	51,500	33.0	60.0
	85	35,100	50,000	35.0	59.1
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C. 1 hr.; 75 per cent reduced by hot forging at 1000 deg. C.; annealed at 950 deg. C. 1 hr.	95	30,700	49,400	29.0	55.8
	97	30,800	50,400	25.5*	54.9
	88	31,300	48,700	29.0	54.5

* Fractured outside of gage length.

erties of considerable interest if sufficiently high molding pressures and sintering temperatures are applied. In practice both are limited by technical and economical considerations. The control of excessive grain growth also puts a limit to the sintering temperature. If iron compacts are twice pressed and heated, and if the raw material is of high purity, densities better than 98 per cent of normal, and hardness, yield point and tensile strength values within the range of fused metal of the same composition can be obtained. However, proportional limit and modulus of elasticity are at least 10 per cent below normal for material prepared in such an elaborate manner. Elongation and reduction in area values reach approximately one-half to two-thirds of standard. The initial powder grade has a certain influence on these data, with fine powders yielding higher strength values and coarse powders improving the ductility.

Hot forging of low pressed and singly sintered iron brings marked improvements in all properties. Density and hardness approach the standard value. Even a moderate reduction of 25 per cent is sufficient to increase very noticeably strength and ductility, thus bringing these values within normal ranges. Modulus of elasticity varies from 65 to 90 per cent of normal, and elongation and reduction in area reach about three-fourths of the customary values. Cold rolling of sintered iron causes a similar tendency in the results.

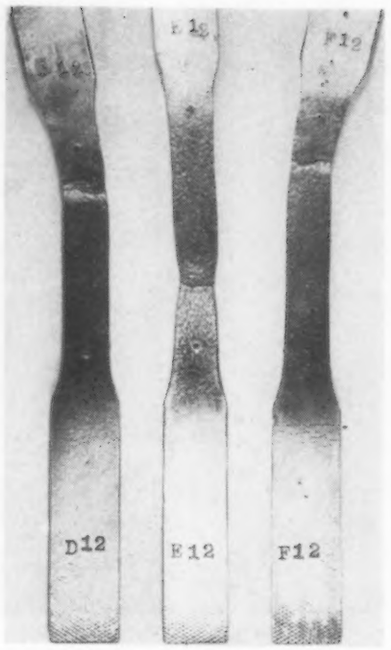


FIG. 12—Triplicate tensile test bars of sintered and cold rolled iron after testing. Hydrogen-reduced sponge iron, —100 mesh, was pressed at 25 tons per sq. in., sintered at 1200 deg. C. and reduced 75 per cent by cold rolling. Annealed at 1000 deg. C. after 25, 50 and 75 per cent reduction. Triplicate bars were machined out of plate, ¼ in. thick, position of bars as indicated in photograph.

The mechanical properties thus achieved are indeed remarkable, considering that the material has been built up artificially without fusion, by integrating an agglomerate of minute metal particles, and by welding these particles together in a sintering treatment, followed by a common metal working practice. They suggest closest study for possible industrial applications.

Today's trend to employ commercially the methods used in powder metallurgy in the mass production of iron and steel parts of complicated shapes, which normally would require a considerable number of machining operations, is well understandable in view of the overburdened tool machine facilities. Besides the necessity of keeping production costs within reasonable limits, a thorough knowledge and judgment of the quality and behavior of the sintered material are essential. It is obvious that molded and sintered parts can only successfully substitute machined parts, if their density, strength, ductility or their electrical and magnetic properties are comparable to the same properties in material made by orthodox metallurgy.

In conclusion, it may be mentioned that the technique of forging, subsequent to cold pressing and sintering, has already been successfully worked out on an industrial scale by H. Tormyn, engineer with Chevrolet Gear & Axle Division. In this operation SAE X 1112 steel turnings after comminution are pressed into ½-lb. compacts, sintered at 1025 deg. C., hot forged and finally coined cold after trimming. These forgings have displaced cast iron bearing lock sleeves which formerly had to be machined on the two faces and the outside rim.

TABLE VII

Tensile Properties of Sintered Hydrogen-Reduced Iron After Cold Rolling

History of Iron Powder Compacts	Density Gm.Per C. C.	Density vs. Iron, Per Cent	Brinell Hardness	Proportional Limit, Lb. Per Sq. In.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Modulus of Elasticity Lb. Per Sq. In. x 10^6	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 25 per cent reduced by cold rolling; annealed	7.04	89.5	55	7,500	25,000	34,600	22.65	9.0	12.8
	7.15	90.9	60	9,800	24,400	37,000	21.5	10.5*	14.3
	7.12	90.5	60	9,200	23,700	34,800	23.4	12.0	16.0
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 50 per cent reduced by cold rolling; annealed	7.62	96.8	90	13,300	32,100	43,000	27.5	22.0	33.7
	7.67	97.5	93	10,500	32,900	41,900	26.2	27.0	48.6
	7.62	96.8	93	11,900	34,400	41,200	23.3	13.0*	20.0
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 75 per cent reduced by cold rolling; annealed	7.70	97.9	90	12,200	34,400	42,700	26.1	13.5*	18.4
	7.74	98.4	93	11,900	35,800	42,800	24.9	27.5	48.6
	7.70	97.9	97	12,200	35,400	41,300	26.8	25.0	29.4
Compressed at 25 tons per sq. in.; sintered at 1200 deg. C., 1 hr.; 75 per cent reduced by cold rolling	7.70	97.9	114	13,700	42,200	51,700	24.7	5.0	12.7
	7.74	98.4	117	13,800	52,000	63,700	27.8	6.0	18.8
	7.73	98.2	121	13,000	47,100	50,900	22.6	5.0	9.4

* Fractured outside of gage length.

"The Great Western Mineral Vault"

By OSGOOD MURDOCK
Western Editor, THE IRON AGE

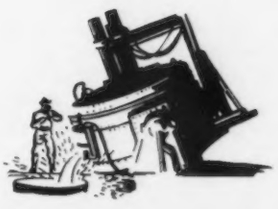
NEVADA'S Senator Pat McCarran, the prospector's pal and the mine owner's messenger to Washington, D.C., leaned back in his chair at the July hearings of the Senate "Silver Committee." His fight was going well to have silver classified as an essential war metal and the price for domestic production raised by Uncle Sam from the artificial price of 71.11c. per oz. to the still more fictitious figure of one dollar.

Silver and gold, prodigies of the sagebrush political bloc, had taken some hard knocks since war necessity had glorified the Cinderella careers of tungsten, chromium, manganese, mercury, copper, lead, zinc, molybdenum, and a whole string of other peacetime mineral Raggedy-Anns. Silver and gold had been snubbed by the strategic and critical list, social register of the war babies. Capital and labor both were turning to other ventures. As the supreme snub, Priority Order P-56 covering mining enterprises, had by definition denied its high ratings to mines producing more than 30 per cent dollar value in gold and silver. Then the tide turned.

After bullying out of Mining Branch Administrator Wilbur A. Nelson acknowledgment that the 30 per cent criterion had originated somewhere in the cerebral back alleys of priority order writers rather than from actual study, the Silver Committee succeeded last May in having the offending definition deleted from the order. Then Donald Nelson, himself, testified that the Treasury was willing to loan for industrial use during the war the portion of its silver hoard that was not actually backing currency; moreover, that still more silver was needed for war uses. Would the Congress, asked Donald Nelson, approve the use of Treasury silver that actually was backing currency as high-voltage bus-bars for the duration? With a 20,000 or so volt potential across the bus-bars, the silver would be as safe as though it continued to be buried at West Point.

That was the cue for the touchdown drive to have silver recognized as a full-fledged war metal which now has reached the twenty-yard line through restrictions on import of silver for non-essential uses. Bus-bars and bearings, solder and chemicals have helped the march. But not until Senator McCarran carries the ball over the dollar an ounce price goal will champagne again flow freely in Reno, Tonopah, and Carson City.

. . . The correct lock combination is lost somewhere in Washington, and far too much of the current effort to release the bolt consists of twirling the dials frantically.



Despite their rise in public estimation, domestic production of most so-called war minerals so far has been one long headache without benefit of aspirin. When war broke out abroad, the RFC commissioned Metals Reserve Co. to purchase essential foreign ores and stockpile them against future needs. Emphasis still was upon obtaining ores from whatever foreign sources could supply them at least cost rather than following the more expensive method of developing domestic deposits. Such purchases abroad also served as a weapon of war—if America could buy all available supplies, none would be left for her enemies. As the stockpile program got under way, however, domestic consumption increased and the stockpiles never grew as rapidly as had been hoped.

It is easy to look back now and see that the stockpile program was started much too late. After a somewhat similar experience during the War of 1914-18, provision was made for stockpiling after the War, but no funds were ever provided. Had this program been carried out as planned, there would be no tears today. On the other hand, these tears would be far more bitter were it not true that the basic metals without which an industrial war economy is impossible, iron and aluminum, are abundantly available within the United States of the western hemisphere. The tightness is principally in those metals used to squeeze the utmost efficiency from these two basic ones.

In days of yore, the sagebrush political bloc liked to refer ora-

torically to the Western states as "a great mineral vault." Now that the time has come to inventory the contents, no one has stepped forward with the correct lock combination, and much of the effort to release the bolt so far has consisted of twirling the dials frantically.

Domestic manganese and chrome ores abound throughout the West but most deposits are far below commercial grade. Were mechanical concentration possible, this problem could be solved at slight additional expense, but often—in the case of domestic manganese particularly—the desired mineral is locked so closely to an unwelcome chemical brother that other commercially untested methods must be used. So the admonition of WPB's William Batt to the steel industry—"patch and pray"—is paraphrased by the mineral experts to "build some million dollar plants and pray."

Secretary of the Interior Harold Ickes has proposed and partially sold the government on an ambitious program of prodigious prospecting, lavish laboratories to study new reduction methods, and help for the little man in the mineral field. Behind his back, as a club, he holds the threat of mine operation by the government. In the ferrous field, of course, he is a thorough-going proponent of "sponge iron" as a sure means to break the steel giants.

Some of these ideas should lead to the country being much better prepared in a mineral way for the next great war, but probably will not bear fruit in time to help win this one. Sounder minds doubt that any new bonanzas rapidly can be found and developed by mere government decree no matter how many geologists are sent scurrying about the countryside, and favor instead digging where ore is known to be. Tested and untested ore reduction methods currently forming the basis of new plants ultimately may not prove to be the best, but the industry feels it is bothered with enough production pests without waiting to get all the bugs out of its processes.

Purchase Depots Operating

As a seducer of investment capital, mining of strategic minerals lacks allure. Metals Reserve Co., buying for the government, has attempted to promote activity by raising its ore purchase prices and lowering the grades which it will accept but so far has not been buried by deliveries. Because chromite characteristically is found in small deposits in the far West, Metals Reserve has answered the pleas of small producers by dropping the size of minimum purchase contracts, offering to accept delivery lots as small as a truckload, and establishing numerous purchase depots at likely points about the countryside. Even with this incentive to offer, one such depot reportedly had not received a single delivery for two months following its establishment. A similar program for the purchase of manganese ore has met with more success. Small deliveries of mercury also are received at the purchase depots.

Zinc, lead, and copper, which present a problem of increasing established production to a greater extent than promoting new operations, are bought by Metals Reserve for a base price plus a bonus for whatever portion of the seller's output is in excess of 1941 production. New mines receive this bonus price for their entire output.

With such incentives, why isn't mining of strategics popular?

A would-be mineral producer may spend considerable sums probing many deposits before he finds one sufficiently profitable to repay his outlay. By that time the war may be over and his market vanished; certainly the tax collector, not taking into account previous unsuccessful prospects, will carry off a major share of the profits of the venture which is finally successful. With little known as to the extent and characteristics of most of the strategic mineral deposits in this country the element of risk is large on any single venture.

Profitwise, strategic mining is like playing a nickel slot machine. If 19 nickels are put in without success, the twentieth nickel must pay a 2000 per cent profit if the sucker is to break even. Only hope of substantial reward attracts investors. If, after depositing 19 nickels without success, the player hits the jackpot on the twentieth, and is taxed as though he had deposited only the final nickel that paid off, he has little chance of coming out ahead. That is how the excess profits tax affects the strategic mining enterprise.

Strategic mineral enterprises were exempt from the excess profits tax during 1940. The following year the exemption was removed, and has not been restored. California records show that production of strategic minerals dropped following the exemption removal.

Tax prospects for the future are not rosy, either. The Treasury wants to remove the depletion allowance of 15 per cent for metal mines. That would mean still less prospect of profit, for unless someone discovers an endless bonanza, depletion of capital—and ore is capital—must still show on the books. A transportation levy has also been proposed. Mines characteristically are located a thousand miles from nowhere, and, since smelter contracts provide that the miner must pay ore transportation charges, the incidence of such a tax would fall on him. Such tax prospects greatly mitigate the attraction of higher unit prices, and capital seeks the comparative security of other types of enterprise.

Labor, too, is fleeing the Western mines for the aircraft factories and shipyards along the Pacific Coast. Besides their lower wage scales, the location of many mines in high mountains or scorching deserts, far from civilization, makes them unattractive places of employment. Dwindling labor crews prevent the mines from undertaking normal development and exploration work, and means that they face slow death as present deposits are exhausted. As crews become smaller, their work must be concentrated on high grade ore in order to cover mill overhead; this too, means that the life of the mines is shortened. These same

VERTICAL envelopment à la Marine. These are practice jumps in the United States in preparation for the real thing in the Solomons, China, Egypt, Berlin, Tokyo and Rome.

trends were apparent during the last war and had not hostilities ended when they did, a serious crisis would have been faced in many metals.

Even when Uncle Sam ostensibly offers a helping hand to the mines he makes it difficult to grasp. Accepted governmental theory seems to be that some bureaucrat three thousand miles away from the scene of action is the only fit judge as to whether a mine shall be granted a loan, assigned a priority, or have a road built to it.

Absentee Overlordship

Reconstruction Finance Corp. will lend money to develop, mine, mill or smelt domestic strategic mineral ores. Although RFC maintains an office in San Francisco, application for all but small development loans must be made to Washington, D. C. After a lag, an overburdened San Francisco engineer is assigned to investigate the property. His findings are reported to Washington, which considers them at due length before approving or disapproving. A somewhat similar procedure is followed by the War Production Board before authority to use priority ratings for repair parts and operating supplies or ratings for new equipment are granted.

Because of the almost perverse inaccessibility of mineral deposits, many developers would like to obtain federal assistance in building access to their mines. Such aid used to be somewhat difficult to obtain, but a recently inaugurated streamlined procedure roughly runs this way: The mine owner applies to a district United States engineer, who calls into conference a number of other agencies to determine the cost and feasibility of the proposed road; the district engineer reports the proposal to a division engineer; the division engineer passes it on to the War Department in Washington, D. C., to ponder along with other questions of the hour; the War Department requests the Bureau of Mines to report to it on the mineral aspects of deposit, and asks the War Production Board whether need for mineral justifies the mines development; the Bureau of Mines presumably asks a field representative to investigate the deposit and report back to headquarters, and the War Production Board queries the branches concerned; then the application reverses its course and, if everyone is agreeable and the mine owner is still alive, the road is built. The order varies somewhat but the number of hands through which the application passes remains constantly high.

This involved buck-passing by federal government agencies has meant that thousands of ton of ore located in high mountain regions have stayed in the ground this summer while complicated application forms shuttled back and forth between the West and the nation's capital. This ore now will not be mined until next summer, because mining and ore transport is impossible in deep winter snows.

Whether despite all these difficulties, domestic production can fill the country's requirements depends to a great extent on how much more they are going to grow. Before entry into the war, prospects were bright. Since, increasing domestic needs, plus greater demands from allies, plus loss of foreign sources, plus loss of vessels to bring ore from remaining foreign sources total up a tight situation.

Just before the shooting started, the old OPM confidently predicted to the steel industry that this year's requirement of tungsten concentrate could be more than met with domestic production of 8000 tons, imports from South America of 8000; imports from China of 5000, and imports from other sources, including Portugal, of 1000. Either domestic or hemisphere production had to be stepped up better than 60 per cent or consumption cut nearly a quarter in the face of expanding requirements.

Substitution of molybdenum, of which the United States produces about 95 per cent of the world total, has eased the tungsten shortage. As domestic copper and tungsten production increases, a parallel rise in molybdenum, often associated geologically, should occur. Moreover, in certain mines which produce molybdenum alone, the chief problem in increasing output has been getting the ore to the surface through miles of congested tunnels. As originally plotted, domestic production for 1942 was 43,000,000 lb., requirements, 54,000,000 lb.

Import figures testify eloquently as to the chromite situation; 43 per cent of 1940 needs came from Africa, 24 per cent from the Philippines, 11 per cent from Turkey, 8 per cent from Cuba, 6 per cent from New Caledonia, 2 per cent from Greece, and 6 per cent from all other sources. A single low grade domestic deposit should, before long, be able to supply a big chunk of domestic needs, but for the balance the country must dig rabbit holes all through the far Western mountains and keep its fingers crossed.

With a background of producing domestically about 3 per cent of ferro-grade manganese needs last year, the country hopes to produce 15 per cent this year. A year ago the plan was to get half of the requirements from this hemisphere —Brazil, Cuba, and Chile—and the balance from Africa, the Philippines, and British India. Significantly, one of the first American ships torpedoed in the Atlantic carried manganese ore. To an even greater extent than with chromite, dependence must be placed on successfully concentrating low grade ores, and much hinges on processes tested only in pilot plants by the Bureau of Mines.

Mercury, whose status as a war baby no longer is principally dependent upon its use as a detonator of explosives, is produced in greater quantity by the Axis than by America. American needs were met last year, however, through the combined efforts of a few mines which have been producing for nearly a hundred years and many smaller new ones. The producers, augmented by a growing Mexican industry, should fill the bill. Mercury deposits are characteristically small, and new deposits must be discovered to supplant those which are exhausted.

Western lobbyists argue that all America's mineral shortages can be met domestically if the unit price is raised sufficiently. One enthusiast, testifying before the Senate Military Affairs Committee, proposed that prices be raised now by statute and kept hoisted after the war so that the mines could be assured of a livelihood.

"To the steel industry," he exclaimed, "higher prices for ferro-alloys would mean no more than a pinch of baking soda to the cost of biscuits." He then compared the cost of an alloying element to the cost of all steel, neglecting to point out that it was a far greater part of some alloys than others.

No one in the mining states will be surprised when some Congressional enthusiast for the Lone Ranger suggests America fight the war with silver bullets.

Anodizing Tank Short

. . . A way to avoid a vexing and expensive problem encountered in the treating of aircraft material. Short circuits in anodizing tanks are avoided permanently and solution life is in the neighborhood of 15 weeks.

IN anodizing aircraft material, whether in chromic acid or sulphuric acid solutions, the tank is almost invariably the cathode. During normal pre-war production, loads were kept light, and often times there was no real need for an insulating medium to prevent the work from touching the tank and causing a short circuit. Since all-out war production has become the watchword, however, all facilities have crowded to overcapacity, and the necessity for a medium to prevent accidental short circuits has become pressing.

Several plants have tried to overcome this problem by the employment of a hardwood latticework suspended along the tank sides and anchored to the tank bottom. For the prevention of short circuits, the wood lattice idea was very good but not perfect in many respects. The chromic acid attacked the wood, and in a comparatively short time the material was literally "burned up." Its worst feature, however, was the fact that the soluble cellulose binder reduced the chromium from the hexavalent state, to the trivalent state. Trivalent compounds are inert with regard to the reactions involved in the anodizing processes, and an accumulation will cause the bath to become inoperative in a very short time. In many cases when a new lining is installed, the new solution will become inoperative within one week from this cause; and over a period of approximatly three months, the solution may have to be discarded several times due to the accumulated trivalent organic chromate. Subsequent runs, after the wood lining has become aged, will show a somewhat longer solution life compared to the first cycle, but the maximum life of solutions, even after a year's run, does not usually exceed five or six weeks. As each

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renewal means in this case the total loss of 750 to 800 lb. of chromic acid, the hardwood lining, in spite of its low first cost (approx. $250), becomes rather expensive. The life of such hardwood lining is usually not very long (about one and one-half to two years at the most), which in turn means that the cycle of short solution life is repeated for each new lining, not to mention the cost of renewed lining.

Other materials such as hard rubber, micarta, and similar products have been tried, but the results, while somewhat better than the hardwood, have not been satisfactory enough to warrant general adoption.

It should be borne in mind that a solid insulating surface is not suitable since the tank must function as the cathode; otherwise there might be a very good application for wired glass such as has been used in conventional decorative chromium plating installations. Wired glass has been very successful in this particular type of work and to some extent in hard chromium plating where a large open tank is used, and several different parts are being plated at the same time. The solid insulation in the latter case is to prevent leakage of current from one unit to another.

An ideal material for the anodizing tank insulation must possess the following qualities:

(a) It must be inert, and insoluble in chromic acid or sulphuric acid in the conventional concentrations employed.

(b) It must be able to withstand temperatures up to 125 deg. F. without deforming or sagging, and be tough and pliable at ordinary bath temperatures.

(c) It must be easily worked and fabricated to the forms and shapes most suitable for the application and the shape of the tank.

(d) It shall not discharge any substance injurious to the solution which would tend to build up its trivalent chromium content.

Of the many materials which are used only one has fulfilled the above requirements in a large production unit for anodizing. This material is known to the trade as Unichrome* Resist sheet and has been marketed for the last seven years as an insulating material for use on chromium plating racks. It is fabricated in sheets 20 x 50 in. from 1/16 in. to 3/8 in. thickness, and in rods of various diameters.

This material has successfully passed the following tests according to reports from other sources:

(a) One-year immersion in 250 gm. per liter chromic acid solution at 55 deg. C.

** Trade Mark Reg. U. S. Pat. Off. by United Chromium, Inc., 51 East 42 St., New York.*

Circuits Overcome . . .

By OTTO H. LOVEN

Chemist, Vought, Sikorsky Aircraft Division of United Aircraft Corp., Stratford, Conn.

(b) Eighty-days' immersion in 8 oz. per gal. alkaline cleaner at 160 deg. F.

(c) As insulation on a chromium plating rack, a piece was successfully passed through a cycle consisting of cleaner, hot and cold rinse, sulphuric acid etch, hot rinse, and subsequent chromium plating several times daily for a period of a year or more without any noticeable change in appearance or structure.

Comparative costs of an installation at this plant covering a wood lattice and a lattice made from the above material show the following differences:

	Wood Lattice	*Unichrome Lattice*
Initial cost of material and labor...	$250	$400
Installation cost....	75	75
Chromic acid consumed in bath make-ups, 1½ years	2,660	840
	$2,985	$1,315

These figures show a total saving of $1,670 for the above period for each tank. It should be noted that the cost of chromic acid used for the periodical additions to maintain the bath is not included in the above cost sheet. Such additions are due to operating causes and drainage losses and are not related to the kind of insulation used. Actually, a slight increase in additions to the baths using the wood was necessary to offset the higher trivalent chromium content, but these additions were difficult to separate and have therefore been disregarded.

In making up the Unichrome Resist sheet lattice work for protection against short circuits, sheets of ⅛ in. and ¼ in. thickness were used. The sheets were cut into strips ½ in. wide on a power shear.

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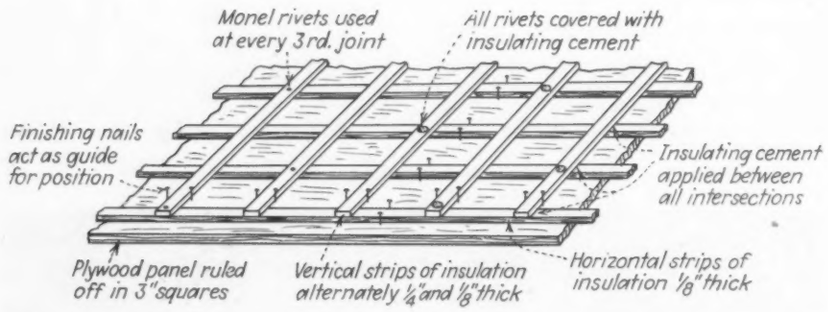
One important precaution must be observed in performing this operation. The temperature of the room and of the material must be at least 68 deg. F., or preferably a little higher. The Unichrome Resist sheet when cold is somewhat brittle and has a tendency to crack under pressure or slight bending.

For ease in handling, and also because the length of the sheets is only 50 in., the lattice is made up in sections of 50 in. width and to the full depth of the tank. On odd

A RECENTLY completed installation of Unichrome Resist lattice work insulation.

size tanks, the odd remaining space at either end may either be added by splicing to the next section or be made up as a separate unit. The bottom sections are made up to the same width as the side sections and fit between the side sections. The end sections are also made the full depth of the tank and just wide enough to fit between the side sections. Usually the tanks are equipped with heating coils at the bottom and air coils above the heating coils. These are used to aerate and mix the solution between loads to prevent stratifying. The bottom lattice sections are supported on the air coils, and the side and end sections stand on the tank bottom.

Rack Coating (a lacquer, which acts as a cement) was spread. Then alternately ¼ in. and ⅛ in. strips were laid down vertically and slight pressure applied to the crosspoints to hold the strips together while the cement dried. Each joint was later given two coats of the cement to form a complete seal at each intersection. In order to assure that work being lifted out of the tank would not catch and break any of the cemented joints, ⅛ in. hollow shank monel metal rivets ½ in. long were installed in every third joint. After the sections were completed, they were stored in a warm, dry room for two or three days to set hard.



Lattice work for protection against short circuits is assembled in this manner.

The first installation in which this material was used might well be taken as an illustration of the above. The inside dimensions of the tank were 18x3x6 ft. deep. The side sections were made up 50 in. wide by 72 in. high, and four sections were used on each side. The sections were spaced 2 in. apart to prevent expansion from pushing one section over the other. The bottom sections were 50 in. wide by 36 in. long. The ends of the bottom sections were threaded between the side sections. The end sections were 36 in. wide by 72 in. long, and the ends of these sections were also threaded in between the side sections.

In assembling the cut strips into lattice sections, a flat plywood board was employed as a fixture. Lines were ruled vertically and horizontally on 3-in. centers representing the center lines of the strips. Other lines, ¼ in. on each side of the center lines, were drawn to represent the edges of the strips, and finishing nails were driven in to act as guides for laying down the strips. Strips ⅛ in. thick were laid down on the board, and on each intersection a drop of Unichrome Air-Dry

After the sections have been thoroughly dried, installation is begun. The two opposing sections, the end section, and the bottom section are set together over the end of the tank, bound together with a few loops of 1/16-in. soft monel metal wire, and lowered in place. The middle sections follow and are installed in a similar manner. Wherever necessary, a few loops of monel wire should be employed to hold the sections in place on the tank bottom by wiring them to the air coils. Suitable supports are attached to the suction duct and fastened to the lattice to give rigidity at the top. Strips of Unichrome Resist sheet should also be used to cover the top supports (which are made of steel for strength) to prevent contact with the work at these points.

The following precautions during assembly of the lattice should be observed. The Unichrome Air-Dry Rack Coating used as a cement should be applied in sufficient amount to form a strong bond around each intersection. When the monel rivets are installed, care should be exercised in driving; otherwise the strips may be cracked. Also, all rivetheads should be given two coats of Unichrome Air-Dry Rack Coating to prevent any possibility of a circuit being completed through them.

Monitor installations, as above described, have been checked weekly for nearly a year and have shown an almost complete absence of any formations of trivalent chromium, and the solution life has been consistently in excess of 12 weeks. On some occasions it has reached 15 weeks. Should at any time an unusual amount of trivalent chromium be noted, it is well to inspect the hot water rinse following the alkaline cleaner to see that the water is kept clean and near boiling temperature, and to see that a sufficient period of draining is allowed after lifting the work out of the alkaline cleaner and the hot rinse.

Before this precaution was observed, it was found on one occasion that three tanks in one installation were showing an unusual amount of trivalent chromium, and that the one nearest to the alkali rinse tank was the highest, and the others less in proportion to the distance from the rinse tank. As soon as the proper rinse and drain periods were allowed, the trouble disappeared entirely and has not shown up again.

In connection with the foregoing observations that the solution life of the anodic bath lies at a maximum of 12 to 15 weeks, one who is familiar with the operation of ordinary chromium plating solutions where the solution life, with good care, is almost indefinite, might ask, "why"? The reason for this short life is due to the gradual increase of dissolved aluminum. Good anodizing is produced with solutions of from 5 and 10 per cent of total chromic acid, with a minimum of 1.5 per cent of free chromic acid. When a sufficient amount of the dissolved aluminum has combined with chromic acid (converting it to aluminum dichromate, which is inert with respect to the reactions involved in anodizing), to cause a concentration of over 8.5 per cent of aluminum dichromate, then the total concentration of chromium salts and chromic acid would have to be more than 10 per cent in order to maintain 1.5 per cent of free chromic acid. It has been found, however, that 10 per cent is the high limit of concentration of total chromic acid above which efficient operation of the bath is not obtained.

The Tropenas Converter

In a Light Castings Foundry

. . . Light castings foundries often lose production time while the floor waits for the furnace, or vice versa. One British foundry has solved this problem by using both a basic electric furnace and a Tropenas converter. The operation of the latter, which meets the afternoon peak casting demand, is described here in some detail.

THROUGH judicious use of an electric furnace and a Tropenas converter a modest British foundry is able to produce just twice as much tonnage in light steel castings as the plant was designed for. Stress is laid on standardized charging and operation of the electric furnace, but a special technique is employed in the cupola supplying iron for the converter.

The electric furnace can be adjusted to produce a heat of steel at precise intervals, day and night, while the Tropenas can produce heats at high speed during the peak casting period, which in most foundries is during the afternoon. Furthermore the Tropenas can use low phosphorus-low sulphur remelt from the basic electric. In conjunction with West Coast (English) hematite this yields a steel with a phosphorus and sulphur content comparable with electric steel.

The converter equipment and process were described before the 39th annual conference of the Institute of British Foundrymen, London, by C. H. Kain and L. W. Sanders. It consists of a Tropenas converter, nominally rated at one long ton, fitted with a positive Rootes blower to furnish air. There is a 27-in. diameter balanced blast cupola capable of melting 3 tons of iron per hr., and one ladle of 4480-lb. capacity for removing the cupola iron for transfer to the converter. In addition there is a lip pouring ladle from which steel is hand-shanked, and several bottom pouring ladles preheated by gas burners.

Although the vessel is nominally of 1 long ton capacity, the first charge is never less than 3024 lb., and this increases as the lining wears. The lining is 8 in. thick, except at the tuyeres side, where it is 11 in. There are five 1⅛-in. diameter tuyeres formed in the rammed lining, for which a proprietary material is used. It is essential to control the moisture content at 8 per cent during ramming, and to take steps to secure adequate drying and preheating before the first charge. The average life of a lining is 70 blows. The timetable is based upon a standardized converter charge, uniform vessel temperature and controlled blowing conditions. The tuyeres must be perfectly perpendicular to the axis of the vessel, an error of a degree or so prolonging the blow 5 to 8 min. and yielding cold steel.

Melting and Desulphurizing

The cupola is fettled and patched each morning, this operation taking roughly 2 hr. The sand bottom is rammed up and a fire started which is allowed to burn through steadily without forced draft, and in about 2 hr. charging begins. As small converters cannot easily be held to size, no patching of the vessel takes place, and the capacity of the vessel increases during the week. Under these conditions a standard cupola charge of constant weight cannot be maintained without seriously modifying the chemical composition of the iron charged to the vessel.

To avoid variation of chemical composition in the charge to the converter, the cupola charges are adjusted. Experience has shown that the converter weight increases along the following lines:—At the beginning of the week 3024 lb. are required, and, as little wear takes place during the first two days, three cupola charges of 1008 lb. to the blow suffice. After the second day the weight increases by 112 lb. to 3136 lb., and four cupola charges of 784 lb. are used. For the fourth day the converter weight will have increased to 3360 lb. and three units of 1120 lb. are used.

Table I shows the cupola charge details for the full week. In this manner a uniform composition is obtained without difficulty, as the following figures for six blows testify:

Carbon, %	3.19,	3.03,	3.11,	3.03,	2.95,	3.00
Silicon, %	1.41,	1.41,	1.41,	1.35,	1.41,	1.13

On the sixth blow the silicon charge was reduced. The charges consist of 70 per cent steel foundry scrap and 30 per cent hematite pig iron, the silicon being adjusted by the use of 45 per cent FeSi to give a final silicon of 1.4 to 1.50 per cent. The coke used is of the Welsh variety, coke to metal ratio being 1:10. Chalk containing 55.0 per cent. CaO and having a moisture content of 1.96 per cent is used instead of limestone, 25 per cent chalk to coke by weight being used. Melting losses despite the sandy nature of the scrap and pig are con-

TABLE I

Cupola Charge Sheet

	No. of Cupola Charges in Converter Charge	Weight of Cupola Charge, Lb.	Total Converter Charge Weight, Lb.
Monday	3	900	2700
Tuesday	3	900	2700
Wednesday	4	700	2800
Thursday	3	1000	3000
Friday	3	1000	3000
Saturday	4	800	3200

stant at 5 per cent. Charging takes place immediately the bed has been made up, and as the cupola is hand charged, the steel is charged first and the pig charged round the sides. Charging is completed in 40 min. The tuyeres of the cupola are set at a height that enables the cupola operator to secure enough metal for the converter in two taps. The taps run at regular intervals of 15 min. with intervals of 5 or 6 min. between each converter charge, during which time the tuyeres are cleaned and the slag-hole made up. Hot iron is secured from the cupola, the temperature being 2660 deg. F. (optical pyrometer).

Soda ash is used for desulphurization, 1 lb. of sodium carbonate to 112 lb. of metal being added to the receiving ladle before tapping. When the metal is tapped a violent reaction occurs and heavy fumes are given off; after the second tap the reaction occurs again. Sulphur reductions as shown by recent analysis are as follows:—

Cupola, Sulphur, %.. 0.071, 0.080, 0.058, 0.078, 0.067
Ladle, Sulphur, %.. 0.032, 0.037, 0.035, 0.035, 0.029

When the metal has come to rest, the ladle is removed from the cupola pit and the metal skimmed ready to be poured into the converter.

Blowing (Converting)

After desulphurization, the weight of the metal is checked and poured into the converter, which is in the charging position. The vessel is run up and the level adjusted by the operator. Blowing always takes place on the same angle. A quadrant is attached to the vessel clearly showing the angle, divisions of 5-10-15-20 deg. being shown by a pointer which revolves with the vessel. Blowing takes place on the 15-deg. mark. After the level is adjusted the blower is started and blast at 4 lb. per sq. in. pressure introduced, the operator records the time on a board and the blow is on.

A normal blow is as follows: As the blast strikes the bath, light yellow sparks and a small flame, going straight up the hood, proceed from the mouth of the converter. In about 5 min. a reddish brown flame appears directly over the tuyeres. This spreads and develops in length and marks the beginning of the ignition period. At this stage any FeSi that may be considered necessary is added to the converter in lumps. Three minutes after ignition the flame attains its full height, and a vigorous boil ejects a little slag and metal from the mouth of the vessel. At this point the blast pressure is gently reduced to 3 lb. per sq. in. and the vessel "moved up into the wind."

TABLE II

Converter Steel Pouring Temperatures and Times

Tropenas Converter	Shanking Heats	Bottom Pouring Heats
	Deg. C.	Deg. C.
Tapping temperature	1660	1600
Temperature—first pour	1630	1560
Temperature—last pour	1575	1530
Time pouring	25 min.	20 min.
No. of molds	88	75
Weight of metal cast	3200 lb.	3000 lb.

It is not considered good practice to reduce the blast pressure rapidly, as sudden reduction results in the loss of the flame. By the time the boil occurs, the bulk of the silicon and manganese have been oxidized, together with a small amount of iron which pass into the slag as silica, manganese oxide and iron oxide respectively. After reducing the blast the flame remains steady, being "solid" and having length, until about 12 min. after ignition when the carbon flame ascends voluminously and intensely white in color. As the carbon becomes exhausted the flame becomes streaked and diminishes in length. At this point the converter is turned down, the blow is completed.

The bath at the end of the blow is in a highly oxidized condition containing approximately C, 0.08; Mn, 0.005; and Si, 0.008 per cent. No reduction of sulphur or phosphorus takes place, and actually a slight increase of these elements occurs, owing to the blowing loss which is roughly 8 per cent. The practice of adding FeSi to the converter is only used when metal is to be hand-shanked. It is found that additions of FeSi have a pronounced effect upon the action of the flame, usually two or more boils taking place and, in the closing stages of the blow, it is not unusual for several false drops of the flame to take place before the carbon is finally exhausted. With such inconsistency of flame the possibility of under or over blowing is considerable.

Finishing and Tapping

After the converter is turned down, deoxidation takes place by the addition of 45 per cent FeSi and 80 per cent FeMn. The FeSi at the rate of 12 lb. per ton is added in tins, the slag being pushed away from the metal and the tins thrust into the bath. The FeMn addition is made by dipping the

(CONTINUED ON PAGE 182)

TABLE III

Properties of Tropenas Converter Steel

Heat No.	Composition, Per Cent				
	C	Si	Mn	S	P
F 9261	0.18	0.22	0.85	0.032	0.037
F 8349	0.33	0.35	1.10	0.032	0.037

Heat No.	Physical Properties			
	Yield Point, Lb. Per Sq. In.	Ultimate Strength, Lb. Per Sq. In.	Elongation, Per Cent	Reduction in Area, Per Cent
F 9261	38,530	71,680	36	56
F 8349	44,800	79,630	24	30

Heat Treating Terms Defined

DEFINITIONS of terms relating to heat treating recently have been proposed by the Nomenclature and Definitions Committee of the American Society for Testing Materials. The definitions are those prepared by a committee comprised of representatives of the American Society for Metals, Society of Automotive Engineers, American Foundrymen's Association, and the American Society for Testing Materials. The definitions are, in effect, a revision of existing standard definitions and are intended to replace, when adopted by A.S.T.M., the present section A-119-33 in the 1939 A.S.T.M. Standards, Part I.

Proposed Definitions

Age Hardening—See **Aging, Precipitation Hardening.**

Aging.—A change in a metal by which its structure recovers from an unstable condition produced by quenching (quench-aging) or by cold working (strain-aging). The change in structure consists in precipitation, often submicroscopic, and is marked by a change in physical properties. Aging which takes place slowly at room temperature may be accelerated by a slight increase in temperature. (See also **Precipitation Hardening.**)

Annealing.*—A process involving heating and cooling applied usually to induce softening. The term is also used to cover treatments intended to: (1) Remove stresses, (2) alter mechanical or physical properties, (3) produce a definite microstructure, and (4) remove gases.

**Certain specific heat-treatments of iron-base alloys covered by the term* annealing *which appear in alphabetic order in these definitions are: Black annealing, blue annealing, box annealing, bright annealing, full annealing, graphitizing, malleablizing, and process annealing.*

Austempering.—A trade name for a patented heat treating process consisting in quenching an iron-base alloy from a temperature above the transformation range in a medium having a high rate of heat abstraction, and maintained, until transformation is complete, at a substantially uniform temperature which is below that of pearlite formation and above that of martensite formation.

Black Annealing.*—A process of box annealing iron-base alloy sheets after hot-rolling, shearing, and pickling.

** The process does not impart a black color to the product if properly done. The name originated in the appearance of the hot rolled material before pickling and annealing.*

Blue Annealing.—A process of annealing iron-base alloys, usually as sheets or strip, in which the initially oxide-free surface is blued by heating at a suitable temperature in air or steam.

Box Annealing.—A process of annealing which is carried out in a suitable closed metal box or pot to prevent oxidation. The charge is usually heated slowly to a temperature below the transformation temperature range and cooled slowly. It is also called **Close Annealing** or **Pot Annealing.**

Bright Annealing.—An annealing process which is usually carried out in a controlled furnace atmosphere so that surface oxidation is reduced to a minimum and the surface remains relatively bright.

Brunorizing.—The trade name for a special treatment applied to rails which, after cooling to a temperature below the transformation range, are reheated to a temperature slightly above that range, and then are allowed to cool in the air, the ends of the rails being partially quenched by jets of compressed air.

Burnt.—A term applied to a metal permanently damaged by being heated to a temperature close to the melting point. The damage may involve melting of some constituent or penetration by, and reaction of the metal with, a gas such as oxygen, or by segregation of component elements of the metal.

Carbo-Nitriding.—A process of casehardening an iron-base alloy by the simultaneous absorption of carbon and nitrogen by heating in a gaseous atmosphere of suitable

(CONTINUED ON PAGE 230)

Occurrence and Production of Molybdenum

By JOHN W. VANDERWILT
Colorado School of Mines, Golden, Colo.

***. . . World production of molybdenum, in the last decade, has increased from a few million pounds to more than 35,000,000 lb. annually. It has become a vital war material, high in the alloying agent hierarchy. Relatively few sources supply the world. This article surveys present and attempted production, and describes the occurrence of molybdenum ores; it is an abstract of a study in the* Colorado School of Mines Quarterly.**

DURING the past ten years, world production of molybdenum has increased fully tenfold, to about 37,000,000 lb. annually. The United States has 90 per cent of the world's production of this metal and it is not therefore classed as "strategic," but because of huge demands by ordnance, aircraft, cutting tools, and the new N.E. steels in which molybdenum substitutes for nickel and tungsten, it is a critical material.

The search for new deposits of molybdenum that could be worked at a profit has been indefatigably conducted for years, and considerable money has been and is still being spent, but none of the sources found in the last half-decade is important in terms of world production and few hold any promises of success. However, a substantial new production has come about from a source little considered even ten years ago—byproduct molybdenite from the copper mines in southwestern United States, Mexico and South America. Though the quantity of molybdenite in the ore is small, the large tonnages of ore treated are yielding several million pounds of molybdenum annually, as can be seen from Table I.

At present there are only eight commercially important producers of molybdenite in the world, and of these, four — Bingham, Utah; Chino, N. M.; Miami, Ariz., and Cananea, Sonora, Mexico, are producers of copper, with molybdenite as a byproduct. Climax, Colo.; Questa, N. M.; Knaben, Norway, and Azégour, French Morocco, are the only commercially important producers of molybdenite as their principal product.

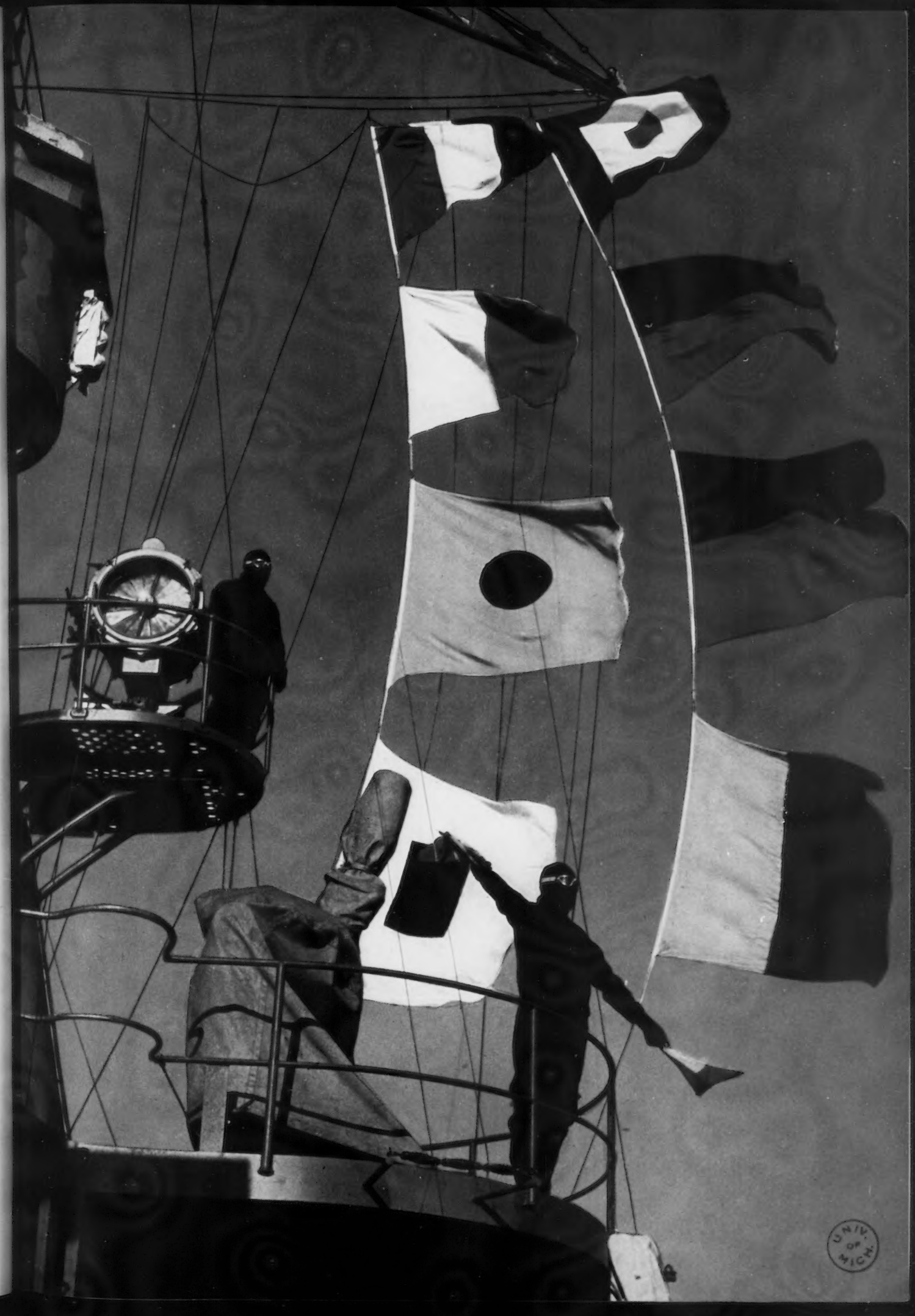
Since 1924, relatively few new molybdenite deposits have been described except in Russia, where numerous occurrences have been found through exploratory work conducted under auspices of the government. The Russian occurrences, according to latest available reports, do not include large deposits.

It is safe to say, however, that molybdenum has been found on every continent and in many countries. Early production came from small high-grade deposits stimulated by a limited and irregular demand. A small supply of molybdenum would exceed the demand, with a resulting fall in prices, which would stop production. On exhaustion of the existing supply, the prices would rise sufficiently to encourage production. This fluctuation of demand, price and production continued until the first World War when prices rose to $2 and $3 per lb. of molybdenum content, encouraging continuous mining of many small deposits and arousing interest in the large low-grade deposit at Climax, and in the Questa, N. M., and Urad, Colo., deposits. After the war, all production stopped until 1923 and most of the older properties were never reopened.

Prior to the present war, production for a time exceeded demand and large stock piles of molybdenite concentrates were accumulated. Since the war, production capacities have, of course, been increasing and will probably continue to increase. It would seem inevitable that production will exceed initial postwar demand, with a decrease in price and a more serious competition for the molybdenum market as possible results.

Well over 99 per cent of the world's production and known reserves of molybdenum have been in the form of molybdenite (MoS_2), a

A COLD blue sky and ideal weather for an enemy attack. This American warship is pushing down periscopes to get another convoy into England. Reproduced from natural color Kodachrome transparency.



relatively common mineral. It occurs in soft, shiny, dark, galena-gray crystals. The mineral most commonly mistaken for it is graphite. Crystals several inches across have been found, but the most common grain size is well under an inch, with the tabular six-sided form usually a little better developed in the smaller sizes. Occasionally masses of molybdenite weighing several hundred pounds are found.

Molybdenite is common in mineral deposits from pegmatites to epithermal veins; there can be little hope at present of an all-satisfying picture as to its origin. According to Hess[1] molybdenite is found in the following associations: Everything in which nonferrous metals are found, though not necessarily in direct association with the nonferrous deposits; in many magnetite-bearing areas; in many places in igneous rocks; in highly altered sediments where other metallic deposits are unknown or unimportant; commonly with tin, tungsten, bismuth and copper; in general, though not exclusively, with the siliceous igneous rocks.

The frequency with which molybdenite is found in gold veins is of interest, because wherever molybdenite has been found in any appreciable quantity, gold is absent. Only traces of gold have been found at Climax or Questa. Gold has not been reported at Knaben, in Norway.

On the other hand, lead or lead-silver veins rarely show molybdenite, but fairly good silver assays have been obtained from select samples at Questa. Moreover, molybdenum, as wulfenite, is a very common associating mineral with lead deposits the world over.

Byproduct of Copper

Another association long recognized is that of molybdenite with copper. Molybdenite, as previously stated, is an important byproduct in some of the disseminated copper deposits of the Southwest, and it is reported in minor quantity in all such deposits, without any exceptions to the writer's knowledge. However, at Ajo, Ariz., Ely, Nev., Morenci, Ariz., and other places, the molybdenite content is said to be too small for production as a byproduct, but Bagdad, Ariz., is a potential small producer. On the other hand, molybdenite is not very common in the copper veins of the large copper mines throughout the world. The copper veins of Butte, Mont., show little or no molybdenite, and the copper deposits of South Africa seem to have none.

Moreover, there are noticeable variations within the disseminated copper deposits. Note for example the following approximate averages:

	Copper	Molybdenite	Gold,
	—Per Cent—		Oz.
Bingham, Utah ..	1	0.04	0.018
Chino, N. M.....	1	0.01	trace
Ajo, Ariz.	1	trace	0.02

On a numerical basis, there are probably more occurrences of molybdenite in and related to pegmatites than any other type. But in such occurrences, the molybdenite is present in small scattered pockets, capable of producing only a few hundred to a few thousand tons of molybdenite ore. The ore shipped is usually limited to what can be obtained by selective mining and careful hand picking, as the quantity is too small to justify construction of a mill.

One of the most important pegmatite deposits was the Moss, or Wood mine in Canada. The zone in which the molybdenum occurs is described as 500 ft. long, 60 ft. wide, and at least 250 ft. deep, with the largest ore body 50 by 200 by 75 ft. Handpicked ore contained as much as 6 per cent molybdenite, although much mine-run ore averaged only 0.6 to 0.7 per cent.

Contact - metamorphic deposits also contain molybdenite in erratic distribution. The average molybdenum content is generally only a few pounds per ton. An attempt was made in New South Wales in 1916 or 1917 to mine this type of deposit, but it proved to be too low grade even with the prevailing high prices being paid by the British government. In general, contact metamorphic deposits have a poor record, although they have the ad-

(CONTINUED ON PAGE 184)

Production in Pounds of Molybdenum in the United States and Comparison with World Production

Year	Climax[1] Colo.	Questa[2] N. M.	Mammoth Arizona	Copper Creek Arizona	Copper[3] Byproduct	Total U. S.	Total[4] Outside U. S.
1909							170,000
1910							187,000
1911							139,000
1912							397,000
1913							201,000
1914						1,297	286,520
1915						181,769	308,560
1916	Small					206,740	687,648
1917	Small					350,200	744,952
1918	342,000					861,637	617,120
1919	152,648					297,926	321,784
1920						34,900	371,272
1921							68,324
1922							72,732
1923	22,667	15,236				37,903	196,156
1924	297,174	135,546				432,720	279,908
1925	1,154,050	313,684				1,467,734	287,540
1926	1,431,830	334,397				1,766,229	306,356
1927	2,286,075	293,513				2,579,588	163,096
1928	3,329,214	460,907				3,790,121	229,216
1929	3,904,648	493,999				4,397,647	257,868
1930	3,759,269	639,280				4,398,549	282,112
1931	3,157,000	480,541				3,157,541	306,356
1932	2,373,000	521,541				2,894,541	492,676
1933	5,761,000	577,537				6,338,537	1,170,325
1934	9,377,000	572,303		69,336		10,018,639	1,199,592
1935	10,892,000	334,287	(5)	356,054		11,582,241	3,158,332
1936	17,959,000	405,638	(5)	1,320,891	480,000	20,155,529	4,793,700
1937	30,122,000	499,232	227,630	943,512	4,890,000	36,681,874	3,266,328
1938	25,414,000	442,133	481,156	607,605	3,480,000	30,450,308	2,940,136
1939	32,414,000	470,314	(5)		7,166,395	40,050,709	3,140,700
1940	25,300,000	484,120	(5)		9,882,597	35,666,597	2,320,812
1941	24,641,000	470,428	(5)		10,051,003	35,162,431	(5)

[1] Coulter, Wm. J., Molybdenum operation at Climax, Colorado Min. Assoc. Yearbook 1942, p. 31.
[2] Vanderwilt, J. W., Geology of the Questa molybdenite deposit, Taos County, N. M. Colo. Sci. Soc. Proc., vol. 13, no. 11, p. 602, 1938, and Carman, J. R., personal communication.
[3] Annual report for year ending 1941, Kennecott Copper Corporation. Figures given in report included production from Braden, Chile, which were deducted as follows: 1939—66,937; 1940—1,000,000; 1941—1,500,000 pounds.
[4] Totals from table 1.
[5] Production figures not available.

ON THE SPOT WITH A PRODUCTION PROBLEM?

. . . . SEND A WIRE TO THE EMERGENCY PRODUCTION SERVICE DEPT. OF KEARNEY & TRECKER

Getting the tools to do the work is often more of a problem than the production job itself. Sometimes it just gets down to having the *know how* to use present equipment or merely adding a standard attachment which adapts or converts an existing milling machine in your plant to a particular operation.

When you are on the spot with a difficult milling job the Emergency Production Service Department of Kearney & Trecker Corporation is at your service. They have the *know how* to be able to suggest getting the most in performance from your present Milwaukee milling machines . . . to extend their range of application and usefulness with standard attachments and accessories.

Kearney & Trecker believes that their Emergency Production Service can help you just as it has helped others faced with production problems. To avail yourself of it all you need to do is pick up your telephone and send a wire, stating your problem, to this Department. Immediately upon receiving your wire, arrangements will be made to have a trained field representative contact you at once. Depending upon the nature of your problem he will provide you with complete technical information or call directly at your plant.

The Emergency Production Service Department of Kearney & Trecker is maintained for your benefit—to aid you in your war effort. We urge you to make use of it.

Here is an exceedingly versatile attachment that should be put to work in your plant — to relieve machine shortage — to avoid the difficulties of getting new machines — to add to the range and usefulness of your present Milwaukee Milling Machines.

It's the Standard High-Speed Adjustable Universal Milling Attachment, shown above in use in conjunction with a low lead attachment and rotary table for end milling a scroll. This is but one of many applications of this versatile tool, such as milling on dies, metal patterns, templets, T-slots, dovetails and other milling operations. When used with a rotary table, circular milling operations can be performed. When used with a dividing head with lead attachment spiral milling operations can be accurately and rapidly performed.

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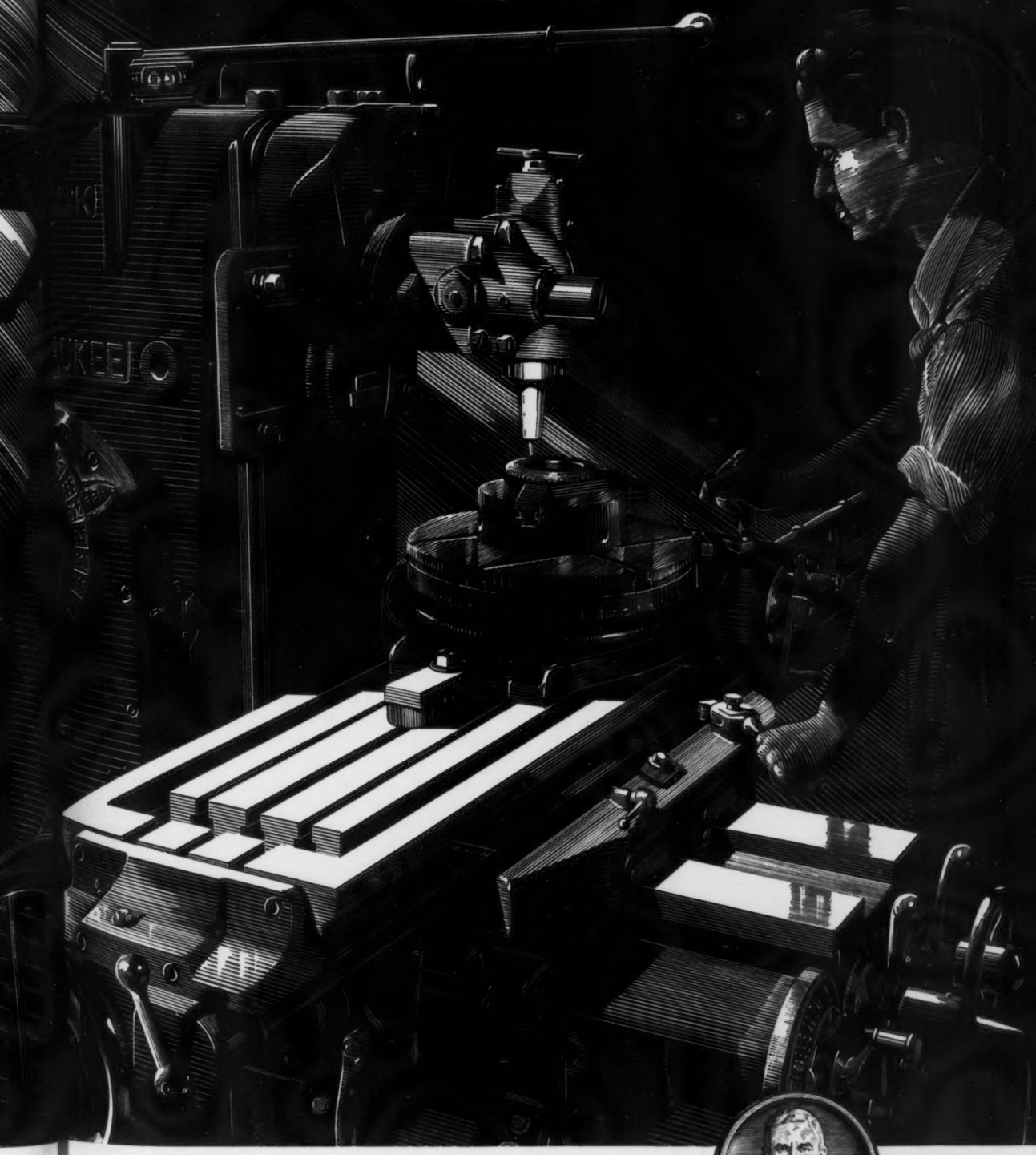

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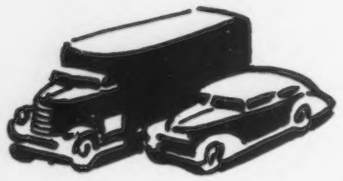
T O O L S

Assembly Line . . .

• Inventories of material purchased for automotive uses being steadily reduced . . . Price ceilings expected on used vehicles soon . . . WPB anticipates early manpower shortages in Detroit area.



DETROIT industry executives are pleased over the new ruling of the Inventory and Requisitioning Branch of WPB relative to shipments of steel and other materials from surplus stocks held in their automotive inventories.

Hitherto, steel had to be delivered to the plant of purchaser at the base price for the purchaser's area, which necessitated absorption by the seller of any differential in base prices, together with the cost of freight to the point of sale. The new regulation, however, provides for f.o.b. sales at the seller's plant and the only loss actually incurred is in the seller's handling charges in putting steel into warehouse.

Without regard to any of these changing regulations, movement of these warehoused stocks, originally purchased to meet then-forthcoming automotive output requirements, has been improved in the last few months. This stems primarily from the fact that increasing scarcity of metals is compelling use of stocks which, while they were not designed particularly for the purpose to which they are now being put, can be so adapted. Large sheets were the first types of steel to move, having fairly ready utilization. But this left a great variety of strip stock on hand in the automotive company inventories. Now, however, some quickening is apparent in the movement of strip, and bar stock is also moving somewhat better.

One major problem remains to be solved before all usable inventory stock can be moved out. With the placing of ceiling prices on material of some kinds, the automobile companies are not at all anxious to move stocks on which they would have to take losses to comply with the ceiling requirements. This situation is especially noticeable in the sale of some stores of copper and aluminum. While quantities are not too large, it is the fact that this consideration constitutes a barrier to complete utilization of all materials on hand, and it can be expected, therefore, that some determination on policy may ultimately emanate from Washington. The automobile companies are perfectly willing to dispose of these stocks in any way the government requires but quite naturally do not feel that they should be put out of pocket on these transactions. At what point the government will step in and order losses to be taken and at what point the amount of any loss will be determined constitute nice decisions which will probably have to be made eventually.

It can be estimated that up to this time disposal has been accomplished somewhat more than half of the total amount of inventory on hand in the automobile companies when production was suspended last February. A process followed by larger companies is to place lists of their surplus materials which cannot be adapted to their own war programs in the hands of WPB and military offices throughout the country. Then, as producers come to these offices to discuss the obtaining of materials for their requirements, they check through such lists. When they find items which they can use, they obtain permission from the military or civil authority involved and consummate the deal directly with the seller company.

INVENTORY - BURDENED smaller companies, for the most part, no not have as complete mechanisms set up, but are finding no insurmountable difficulty in disposing of their stocks.

Today's amplified pace is expected to continue for a time until the stocks which remain are little more than remnants, passed over so often in the picking process that they have little practical value aside from the automotive uses for which they were originally intended. Junking of such remnants may eventuate, or else the material will be warehoused throughout the war for ultimate automotive use.

Informed circles in the automotive industry would not be at all surprised to see used cars frozen and rationed in the very near future. Along with such actions might quite possibly be a price ceiling on the second hand cars.

Drafting of a price ceiling for used cars has been a headache for Washington for some time past, inasmuch as the depreciation rate on many makes is proportionately much more rapid than on the low priced, mass production cars. No general formula can be applied. But it is known that OPA has been giving attention to the development of a cover-all application in recent weeks. Interesting is some expectation that the price ceiling formula might be broken into two schedules—one for cars sold as is, and the second applying on renovated and guaranteed cars. The second ceiling would be higher than the first, the reason being that this would give dealers an incentive to conserve passenger cars by reconditioning them thoroughly, thus providing a contribution to the maintenance of present automotive transport facilities.

Used car stocks have been diminishing since early this year. This National Automobile Dealers Association estimates that against a supply of 28 cars per average dealer in January, cars on hand as of July had fallen to about 17 per dealer, or approximately a 50-day supply. Naturally, the trade-ins on present stocks of upwards of half a million units will stretch out this 50-day supply indefinitely.

On the dealer side, NADA meetings around the country, in progress during the past month, have indicated that agency mortality since early this year has been considerably less than was expected. Competent estimates are that doors have closed on no more than 10 per cent of 40,000 dealers operating as of Jan. 1st, and that a good number of these shut up shop due to draft calls or the obtaining of com-

P&W Photo—Unretouched

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This is a taper cutter in the making . . . getting its teeth milled . . . here acquiring what we call "backing off." The angles on these teeth are tremendously important for strength, chip clearance and smooth, accurate cutting ability. Yet you never need worry about them . . . that's our job. We've spent long hours finding out what they should be . . . and we give you the right cutters to do your job.

If you have this P&W taper cutter — or any other P&W small tools, machine tools, or gages — note this: *war production is burdening P&W products with more high-speed, unrelenting work than their purchasers ever expected . . . yet P&W products are standing up in this ordeal, delivering all the accuracy of finished work always associated with this superior line.*

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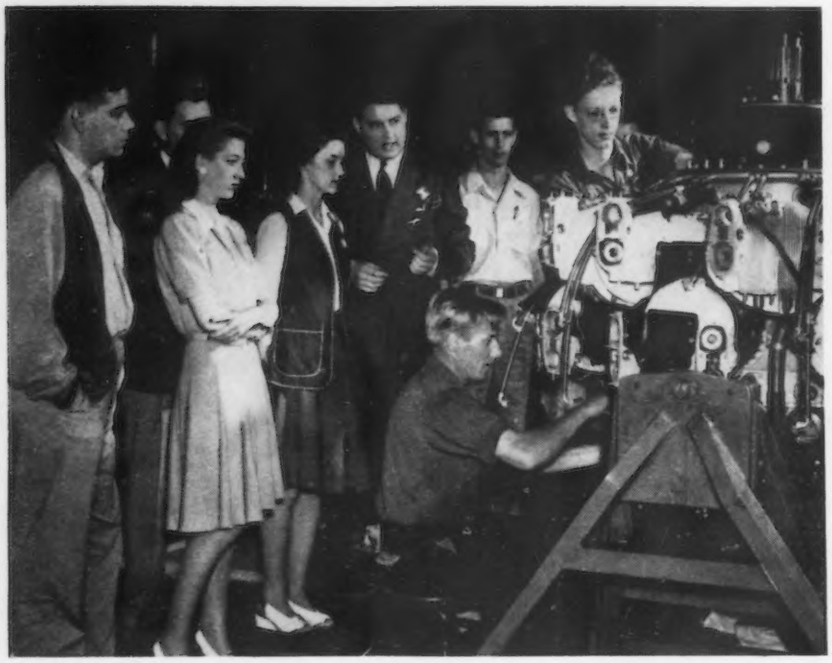


Photo by British-Combine

ALL WORKERS SHOWN HOW: Wright Aeronautical Corp. has set up a project in its Ohio plant to take every one of its thousands of workers on a factory tour from foundries through machine shops and assembly floors to test cells. (Wright believes an employee works with greater interest in his job if he knows what his efforts mean to the final product.) Shown here are workers watching assembly of a Cyclone aircraft engine.

missions, or to consolidation with other agencies. Actual failures are very low. This supports factory-gathered data which indicates that dealer profits since the first of this year have been surprisingly good—better in many instances, than the net income showings of last year to this date. This is ascribed to the fact that dealers have been operating more efficiently, due to today's conditions, than perhaps ever before in their history. Superfluities have been trimmed off and the operating establishments are down to bed rock. Further, panic-inspired selling of greatly-discounted cars, prevalent during the early stages of rationing, has all but ended since passage of the Murray-Patman Act. This act provides that the RFC will make loans on cars in stock up to full cost price, and will buy vehicles remaining on hand in July, 1943.

UP to now the retention of mechanics for repair work has proved a problem to the dealerships. The pay competition of war plants has been a major factor; so has the attitude of some United States Employment Service local heads, who waved a vague threat of "no occupational deferment" over the heads of automobile mechanics hesitant about going into arms plants.

This particular problem, however, is scheduled for early solution. The Office of Defense Transportation will shortly embark on a nationwide campaign to drive home to the auto mechanic the importance of his job in keeping transportation at normal. This, along with relief from the localized USES siphoning of mechanics from the garages to arms industry, is expected to provide a more stable situation.

A rather startling anticipation that a definite shortage of man power will exist within the Detroit area within a few weeks has been made by D. J. Hutchins, WPB Detroit regional chief.

It was pointed out that the automobile industry indicated some time ago that 153,000 additional workers would be hired in the Detroit area during the last half of 1942. At the same time, it was estimated that this period would see nearly 50,000 men of working age called into the armed services, leaving only 20,000 to 30,000 unemployed workers available.

Under these circumstances, Mr. Hutchins recommends strongly in letters to manufacturers' associations that war industries take immediate preparatory steps toward using women workers on production lines. His "preparatory steps" included not only training programs but also the setting up of necessary facilities such as rest rooms, first aid rooms, etc. It was declared that material shortages and balancing of production schedules might bring about a downward revision in earlier labor estimates for the last half of 1942, but that it was obvious that a definite shortage of man power would develop very shortly.

Mr. Hutchins said classification of the recent registration of women for war plant work is nearly completed. It shows approximately 180,000 willing to accept industrial work, of which some 53,000 have had previous factory experience.

Blanks Being Mailed to Commercial Vehicle Owners

Detroit

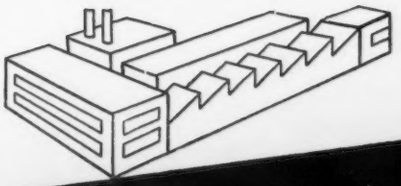
○ ● ○ **The Office of** Defense Transportation is scheduled to begin mailing more than five million application blanks this week to commercial vehicle owners throughout the country who will need certificates of necessity for operation.

Blanks will be sent to all who registered as taxi, bus or truck owners on Dec. 31, last. The certificates subsequently issued will be necessary for commercial vehicle operation under new regulations promulgated by Washington.

Chicago Industrial Output Tops $7 Billion

Chicago

○ ● ○ **Industrial plants in** the Chicago area are now producing goods at the rate of $7,461,234,000 a year, according to estimates of the Chicago Association of Commerce. When plants still under construction come into production, it is expected that this rate will rise to as high as $11,131,894,000. One of the factors in boosting this production rate will be the new Dodge airplane engine plant to be built here. This plant will be the largest to be built in America under the war program. Another important plant will be the new plant erected by the Aluminum Co. of America.



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Tools that crack in hardening or fail prematurely mean precious time lost in "doing jobs over." It's time that *could* be made to yield *more* tools.

The Carpenter *Matched Set* Program is helping to solve this problem by simplifying the selection and heat treatment of tool steel for each job. And to further step up the output of every skilled worker, Carpenter has published a 315-page handbook, "Tool Steel Simplified." Over 26,500 copies are now being used to help workers produce better tools faster. It answers questions on size change, warping, grinding checks and the relation of design to heat treatment. Let "Tool Steel Simplified" provide practical help for *your* apprentices and skilled workers.

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Every time a machine or press is shut down for tool and die repairs or regrinding, you are losing valuable time that *can* be saved. The Carpenter *Matched Set* Method of selecting and heat treating tool steel has proved this in over 1,500 plants. Typical reports: *"Output up 52,500 pieces per month" . . . "Production capacity of tools up 20% to 100%."*

If you would like to know how to boost your machine and press output, send for "Tool Steel Simplified." It tells *how* to select the best tool steel for each job, and *how* to heat treat it for best results. Let this handbook answer many of the questions that come up in your plant. It is available at cost to tool steel users in the U. S. A.—$1.00 ($3.50 elsewhere). After you have read it, you will want more men in your plant to have copies.

This handbook is the foundation of many plant programs for *more production from every man and each machine.* It is written in shop language so your men will be able to apply it to their work. Available *at cost* to tool steel users in the U.S.A. —$1 ($3.50 elsewhere). Order your copy today.

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Dept. 101, Reading, Pa.

Carpenter MATCHED TOOL STEELS

Washington . . .

• Industry here on the edge of wholesale concentration. The implications are unpleasant, but British experience indicates imperativeness of such action with the government forcing action and acting as umpire.

WASHINGTON — Industry, plagued by pestilential political plans for its control and betterment, faces concentration. The word has an unpleasant sound, and business may discover that the practice of limiting production of a given item on a selective basis to a few plants is as disagreeable as the idea. WPB has already ordered bicycle and stove production concentrated, and is in the process of ordering farm machinery manufacture concentrated. Industrialists may feel like balking but will have to endure Washington's ministrations whether they are efficient and fair or not.

The purposes of concentration as WPB puts it are: To save critical materials; to free the firms not concentrated so they can engage all of their facilities in war work; to enable the companies in an industry which have had production previously restricted by WPB limitation orders to resume profitable operations; and to relieve labor shortages where an industry subject to restrictions in using men who could be better employed by an industry devoted to war work.

WPB says that the way it will choose "nucleus plants," the ones which will be permitted to continue production at or near capacity of products subject to limitation, will not be governed by hard and fast rules. However, it proposes the following criteria as a guide in making such selections:

As a rule, though not invariably, small plants will be kept in civilian production and large plants, which are usually better equipped to handle war contracts, will be required to suspend civilian production.

Civilian production should be suspended in areas where labor is urgently needed in war plants, and nucleus status should be given wherever possible to plants in areas where there is still a surplus of labor, as for example, in New York, and in many rural communities.

Nucleus firms should be selected so that cross-hauling is eliminated wherever possible and the drain on transportation facilities is reduced. Production should be suspended or restricted in regions where the power supply is or is likely to become inadequate. As a general rule nucleus plants should not be located in areas where warehouse accommodations are short.

AT the time when Donald M. Nelson, WPB chairman, announced that concentration of industry would become a policy with WPB, he said that the board fully realized that concentration of civilian production raises many difficult problems—compensation to closed firms, maintenance of trade marks, rearrangment of distributive channels, and so on. But, while these are of great importance to the individual firms involved, he said, from the standpoint of war production they are secondary to the need for determining the degree of curtailment, concentrating production and converting non-nucleus firms to war work. In working out concentration plants, he said, the board feels that these principles should be applied.

Concentration plans should not foster post-war domination of an industry by one or a few companies. In other words, a plan which will make possible the reentry of the largest number of firms into the industry after the war should be given preference, so long as it is consistent with efficient prosecution of the war.

Wherever possible, concentration plans should be accompanied by standardization and simplification of the product. Concentration programs should be drafted for limited periods, with one year as a maximum, and should be flexible enough so that they can be revised if circumstances change.

A concentration program for any industry should be coordinated with any program which OPA may work out for concentration of the distributive channels of that industry.

Where compensation is provided for closed firms, it would be paid by the firms which continue operations, and should be limited to the duration of the conservation program. This would presumably include either an agency scheme, under which nucleus firms produce at cost for closed firms which retain their sales organizations, or a pooling scheme which concentrates both production and distribution in the nucleus firms.

The British have been working with schemes to concentrate industry since early in 1941, and late in July Mr. Nelson sent Dr. Arthur R. Burns, chief of the civilian planning branch of the Office of Civilian Supply, and Henry A. Dinegar, chief of concentration for the same office, to England to study British methods.

The concentration of industry in England was fostered by Capt. Oliver Lyttelton, British Minister of Production. In Britain straight percentage cuts had been imposed on a long list of civilian industries, just as they have been imposed by the WPB limitation orders. According to the British, the system of imposing straight percentage cuts proved wasteful.

"All the household utensil manufacturers, for example, were trying to stay in business even though each one could make only 25 per cent of his normal output," a British report said. Furthermore, "Many of the plants were located in cities where there were critical shortages of factory space, labor, power, tools, warehouse space and transport for war production."

Captain Lyttelton's staff worked out the essential military and civilian requirements for each product. Each industry was asked to concentrate production in nucleus plants, located in non-critical areas, and was told if a concentration program was not worked out by the industry, the government would impose one. Later, the government was forced to do the job and the "self-determination" principle was dropped.

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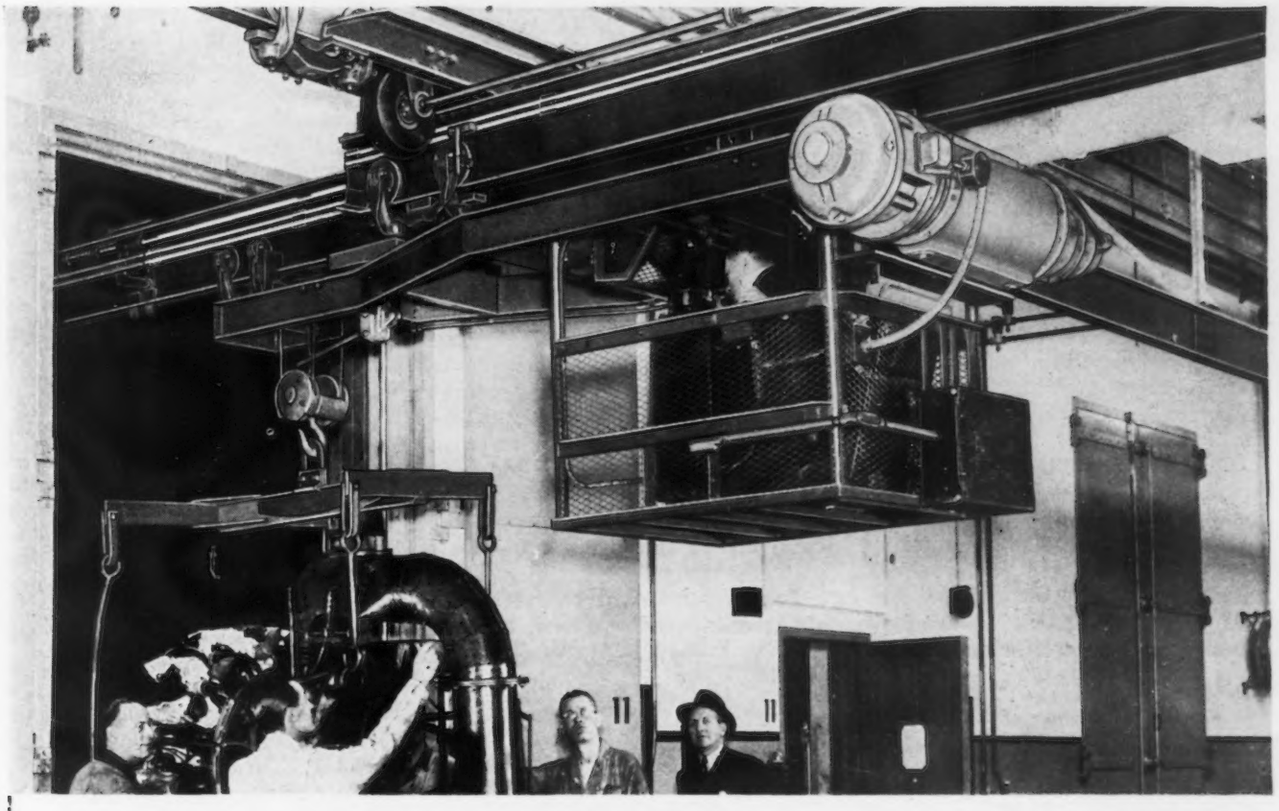

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The plans adopted ranged all the way from those in which the nucleus firms manufactured a standardized model, such as American victory model bicycles, to those in which the nucleus firms manufactured the brand products of the converted firms, as well as their own brand products. The nucleus firms paid part of their profits to the non-nucleus firms.

THE industries which had been concentrated up to April 1, were: Bedding, bicycle, shoe, carpet, corsets, cutlery and razor blades, fountain pens, gloves, hosiery, jewelry, leather goods, linoleum, musical instruments, paper boxes, photography, pianos, pottery, sports goods, toilet preparations, toys, umbrellas, iron and steel, glazed tiles, woodworking, jute, silk, wool, cotton and rayon, paper mills and the sheepskin dealing industry.

Of the 6578 plants in these industries, 2203 which represented roughly 75 per cent of the capacity of the industries, had been taken for conversion and 4315 small plants which represented 25 per cent of the capacity had been granted nucleus certificates.

Upon the return of Mr. Dinegar and Dr. Burns they reported that while it was recognized, before making the journey, that many factors influencing the necessity for concentration and its working in Britain differ materially from those in this country the visit was considered worthwhile. Highlights are: what the British call the "nominative" system is now preferred to the system under which an industry worked out for itself its scheme for concentration. Concentration was effected by industries themselves under British Board of Trade directives, but it is now felt in England that the responsibilities of the job are too great for an industry itself to undertake. The job is one that emphatically needs an umpire the British say, and industry over there is insisting that the government take the responsibility of determining which firms are to cease production, and also the methods of preserving trade marks and good will, and providing for the physical care and maintenance of closed plants.

Progress made in concentration of American industry will be outlined in THE IRON AGE of Oct. 8.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

Blaw-Knox Completes 100th Anti-Aircraft Gun

Martins Ferry, Ohio

• • • **Completion** of the one hundredth 40-millimeter anti-aircraft gun ahead of schedule was observed at a ceremony last week at the plant of the Martins Ferry Division of the Blaw-Knox Company.

The plant, which is not yet in full production, delivered its first gun on May 1, and started production in December, 1941, after being converted from a tin plate mill in record time. Demolition of old machinery was started on June 1, 1942.

Coal Production Up in Western Pa. Over Last Year

Pittsburgh

• • • **Spurred by the** demands of war industries for coal, mines from nine Western Pennsylvania counties increased their production for the first seven months of this year by more than nine million tons over the corresponding period of 1941, Byron Canon, executive secretary of the Western Pennsylvania Coal Operators Association, announced last week.

The production for the year to the first of August was 50,978,303 tons, as compared with 1941's 41,607,944. The increase is approximately 23 per cent, and the seven-month total production would fill more than a million freight cars.

Of the total output, 23,970,000 tons came from captive mines, 2,169,484 tons from truck mines and 24,838,217 from commercial mines.

Production Ideas Win Awards for Packard Workers

Detroit

• • • **National WPB awards** for production short cuts were made to nine employees of Packard war plants here by D. J. Hutchins, newly appointed regional director. The awards were made in the departments where the men were at work. Mr. Hutchins spoke briefly, in the company of Army, Navy, Packard and union officials. The nine awards constituted the single largest group included in the first 33 recognitions released by the WPB. The Packard men were the first in Detroit and the first in the automotive industry to receive the distinction.

Suggestions for MORE EFFECTIVE INSPECTION PRACTICE

1 Establish a definite wear allowance for all fixed size gages, plugs, rings, etc.

2 Check these gages periodically to determine when wear has eliminated this allowance.

3 In final inspection it is better to use an instrument than a fixed size gage when the wear allowance of the gage by the 5-10% rule is established at .0001″ or less. Here the human factor is usually important enough to outweigh the effect of the wear allowance and gaging results become questionable.

4 It is ordinarily not best to use a conventional snap gage for the inspection of work having a manufacturing tolerance of .002″ or less.

5 Keep plugs and rings oiled when not in use.

6 Be sure that both work and gage are clean before they are brought together.

7 Periodically check your precision gage blocks for wear, against a set of certified blocks. Redesignate them when wear is revealed.

8 In setting a comparator gage be sure that both gage and precision blocks are at the same temperature.

9 It is well to check the calibration of indicating type comparators periodically. If an error is found, it is better to send the comparator back to the factory for recalibration.

10 If you are using Multichek gages insist on the operators handling them smoothly. Work should never be jammed violently into gaging position.

WEST COAST . . .

• Plane plants likely to lose still more men to Army . . . Coast officials urge recruiting of women, also of deferred classification men from non-essential jobs . . . Labor shortage hits production in Pacific Northwest.

SAN FRANCISCO — Pacific Coast representatives of the War Manpower Commission, the Selective Service and the War Production Board Labor Production Branch, anxious to propitiate employers howling for labor, last week sniffed the air, bayed and went into a point.

Their scent may have been false, but at least it gives personnel managers an idea as to what the government thinks their next quarry should be. The government recommendation is twofold:

1. More substitution of women for men.

2. Increased recruiting of deferred classification men from non-essential jobs in the same area.

Just how tough these labor force bloodhounds can be was indicated by their unanimous unequivocal statement that there will be more rather than less men taken for military service from the aircraft and shipbuilding industries. These industries have been loud in their complaint that Selective Service was cold bloodedly robbing them of some key men, and intimidating others into immediate enlistment by issuing statements that draft is imminent for those with minor family responsibilities. Selective Service disclaims any intention of crippling industry by taking key men, but, when speaking straight out rather than from the corner of its mouth, states that the extremely high proportion of young workers in the aircraft plants and shipyards makes them the logical source of added military personnel.

THE cross country trek of a pied piper from Portland, detailed by the Kaiser shipyards to entice New York workers to the Western Seaboard, apparently did not sit well with anyone but the Kaiser organization, the travelers themselves, and adjacent employers who had a momentary flicker of hope that an influx of new labor would take the heat off their own personnel. Some government agencies got so worked up that it appears that statements by the Kaiser organization that "further recruiting will be delayed for at least another week" and "we now have more than enough for the immediate needs of the yard" may have been inspired by more than the necessity for the labor piper to change a reed.

Liberal labor thinkers believe that importation of limited numbers to the Portland area may have some justification in that essential industry there is short about 40,000 men. Even if the politicians worked, it is manifestly difficult to increase that number from a city of 400,000 population. But neither is it easy to find a place for any newcomers to sup and sleep in a boom city which three years ago had all the characteristics of a transplanted New England town. Reportedly, the Kaiser organization tapped New York for 3500 workers to come to the Portland area.

Shipbuilding is not the first industry to try drawing upon surplus labor pools in other parts of the country to fill Pacific Coast needs. But every other industry to consider it, mining in particular, heretofore has come to the conclusion that when the workers were dropped, postpaid, in the West, they would immediately depart for the higher wages of the shipyards rather than remain at the task for which they were imported. Since shipbuilding is the best paying industry by some $50 a month, it has no worries along this line.

WHEN California housing authorities awoke last Monday to read of Kaiser plans to import 50,000 workers in all, they immediately hid their heads under the pillows. Paul McNutt, War Manpower Commission chief, stated before the House Migration Committee a fortnight ago that Seattle was short 78,000 workers and Portland-Tacoma 55,000 to 75,000. This gave the Pacific Northwest the dubious honor of being shorter handed than any other section of the country, beating Philadelphia, Detroit, Baltimore and Buffalo without even puffing. Either the picture has changed since McNutt testified, or else he was not fully quoted, for thoroughly reliable figures now indicate that the San Francisco—East Bay area will breast the tape ahead of the Pacific Northwest. Even so, importation of labor is frowned upon—for awhile anyway. Last month the mail men of Oakland (in the East Bay) conducted a house to house survey of possible vacancies for war workers, and delivered a verdict that the vacancy rate was one sixteenth of one per cent. Since then the "For Rent" signs have decreased considerably. One cozy little home reported last week consisted of a one room auto trailer in which eleven people were sleeping in shifts, the children snoozing on the ground under the trailer. For four weeks, one shipyard worker, his wife and four children ate their morning and evening meals at the white-table cloth restaurants, but spent their sleeping hours, if any, in their automobile. This area, which boasts three Kaiser yards, is not exactly receptive to talk of 50,000 imported workers from the East, even though it would not get all of them by any means.

IF the influx can be spread out over a period of several months, the barkers can shout "Go West, young man!" in a louder tone of voice. Housing accommodations are being planned for the East Bay to accommodate between 10,000 and 16,000 persons, but they are not scheduled to be slapped together until Feb. 1. Portland is scheduled to have accommodations for 16,000 people completed by Jan. 1.

Housing for war workers from now on, will not be of the cozy cottage, pink bathroom type. Most of the men will be living in barracks, whether they are in industrial or military service. If families must be accommodated, partitions will be added accordingly. Every one will have privacy, a stove, heat and a

THE FIRST *Heat Engine* TO CONQUER A DICTATOR

Behind massive stone walls, the feudal dictator held life-and-death power over his hapless subjects. Then the common man found a way to shatter the masonry by throwing heavy metal balls from a distance—and the feudal dictatorship was doomed.

The primitive cannon and the modern internal combustion engines of today have a common parentage . . . both are heat engines. As the first cannon gave direction to the expansive power of burning gases, so modern engines and motors must be harnessed to their loads to direct their power for efficient service.

The essential link (the clutch) which connects an engine or motor to its load is the specialized business of the Twin Disc Clutch Company. For nearly a quarter of a century, research, design, engineering, specially-developed test equipment and the last word in production facilities, have been devoted to the fulfillment of a single idea:

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Engine builders and machinery manufacturers, large and small, have learned that this specialization results in a better clutch—either friction or hydraulic—at a lower cost. War needs dictate present deliveries but our engineers will gladly consult with yours toward the development of units which will meet tomorrow's needs by doing the job easier, faster or better. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin.

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CLUTCHES AND HYDRAULIC DRIVES
REG. U. S. PAT. OFF.

bathroom, and a place to sleep. That's about all.

San Francisco, of all the Coast cities, is the most likely one in which to take the government labor agencies' suggestion that industrial manpower can be drawn from non-essential occupations. This city never won its spurs on heavy industry, but rather grew up as the financial, commercial, foreign trade, and distributing center of the Coast. None of these occupational groups, with the possible exception of distribution, ranks as essential to a wartime economy, and the foreign trade group has already disappeared. The financial, commercial and distribution categories are admirably suited to complete conversion to women workers. So, if the government is right, it looks like a double shift—from home maker to commercial worker for the women, and from commercial worker to industry for the men.

Introduction of women into heavy industry continues to make slow headway from week to week. In August one Pacific Northwest aircraft plant had 29 per cent women, more than double the average for the southern California area, where only 13 per cent of the aircraft factory employees are women, even counting office and clerical workers. The shipyards whose employment in California is only slightly behind the aircraft plants, and whose payrolls are slightly ahead, employ only 3.5 per cent women, counting clerical employees. About half of these are employed at a Navy yard, indicating that Uncle Sam practises as he preaches. Among the California aircraft plants, Consolidated employs proportionately the most women and Lockheed proportionately the fewest, with only about 2000 female workers on the payroll.

CONCRETE indication of how labor shortage is affecting industrial production in the Pacific Northwest comes from testimony offered by a representative of Ohio Ferro-Alloys Corp. at a Seattle manpower hearing.

Referring to the firm's Tacoma plant, the representative stated that "We already have had to shut down one of our furnaces for 72 hr. We've got to have men or we will have to shut down and the Army and Navy will have to get along without our products. If the government wants to take our men, all right; we'll have to shut down, that's all. If we don't get relief, there is no other course.

"Prior to the Navy's taking over the Tacoma plant of the Seattle-Tacoma Shipbuilding Corp. on a cost plus basis, we had people waiting to go to work for us. Now they're walking all over each other doing nothing and getting from 12½c. to 15c. an hour more, for easier work, than we can pay our men to work hard."

The comment is not untypical, although seldom so forcefully stated.

Another attempt to settle the question of wage standards for the aircraft industry—the first since collapse of the industry wide stabilization conferences in July—is being made in a calmer atmosphere this week in hearings before a War Labor Board panel at Los Angeles considering proposals for a new CIO contract at North American Aviation, Inc. Although the hearings ostensibly will lead only to WLB recommendations for a contract between the CIO and North American, the case is regarded in the industry as a "guinea pig" which may determine the basic wage and working condition terms of labor contracts throughout the industry. Significant of the importance of the hearings is the intention of all other major aircraft manufacturers in the area to sit in on the meeting. Moreover, Paul R. Porter, stabilization chief of WPB's Labor Production Branch, who presided at the ill fated industry's stabilization conference, and Arnold Tolles are likewise present. Chairman of the WLB Panel is Dr. Paul A. Dodd, associate economics professor of the University of California at Los Angeles.

If a contract decreed by the WLB for North American does become a model for the rest of the industry, it will not be the first time. Following negotiation of the first North American-CIO contract in 1941, this document became the bellwether for labor agreements in other southern California aircraft plants. This original 1941 contract came after the Army had taken over the plant to halt a strike, the first such action in a major industrial plant. Noticeably absent in the early stages of the current hearings is any representative of the OPA who might dampen union ardor by suggesting that aircraft wages already had reached the highest level commensurate with halting inflation.

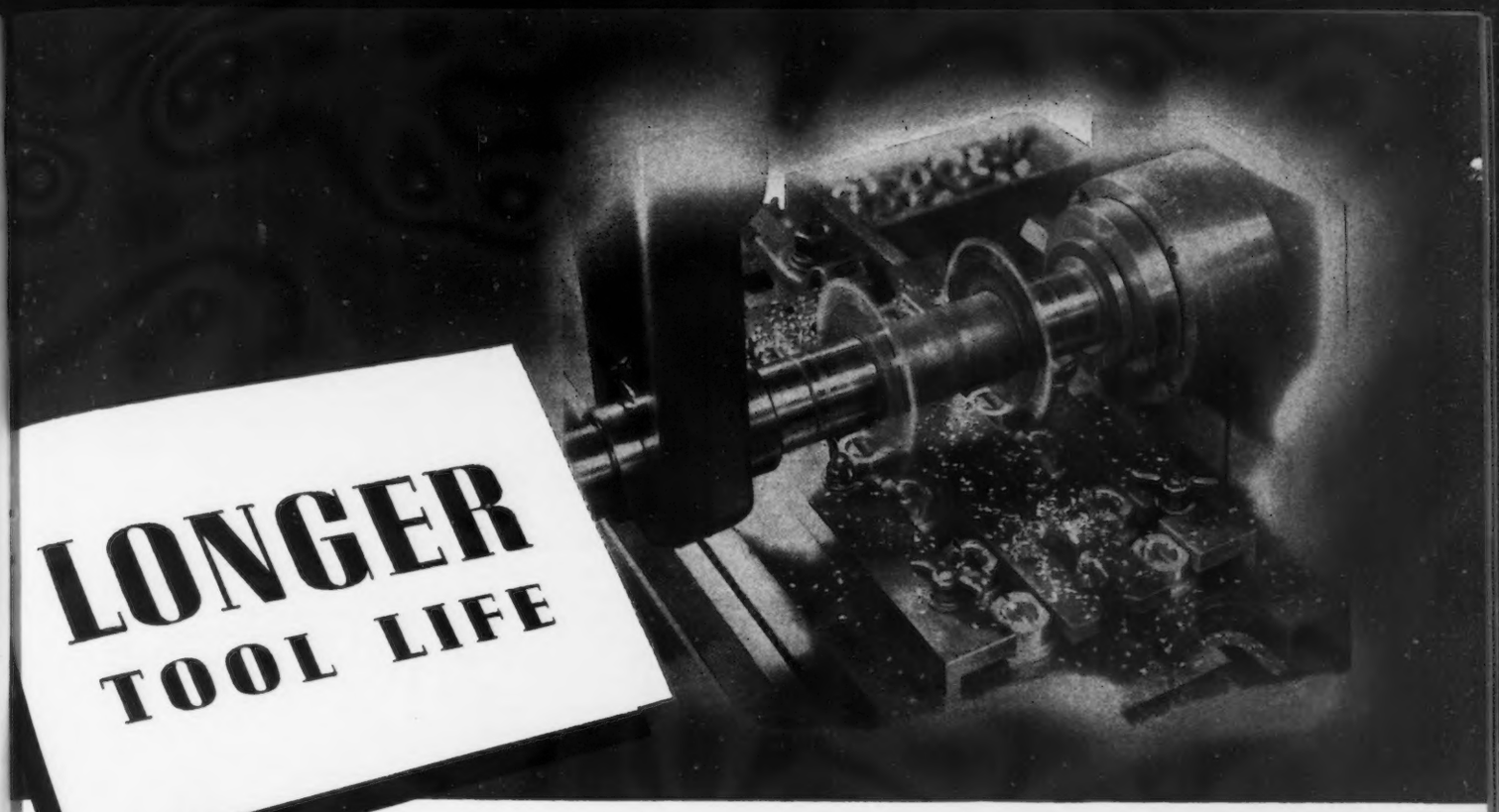
British-Combine Photo

SIX-POUNDER FOR FIELD AND TANKS: This new six-pounder gun is shown being tried on an English firing range. The gun, which has a high rate of fire and good armor-piercing qualities is said to be equally useful as a field gun and in tanks. Much is expected of this gun in Libya.

42,500 Tons of Cans Speed Buffalo Mills

Buffalo

• • • **A checkup this week** revealed that Buffalo district steel plants have received about 42,500 tons of detinned steel so far this year. The greater part of this tonnage was formerly old tin cans —a fact that ought to impress householders with the importance of saving and preparing them for the special collections.



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Fatigue Cracks

BY A. H. DIX

One Says It Is

• • • We would guess that Elmer Davis, head of the Office of War Information, has the country's toughest press agenting job. His clients are highstrung, competitive, and talk too much at some times and too little at others. Moreover, what one says is sometimes contradicted by another. For instance, the Army Air Corps credits Captain Colin Kelly and crew with having sunk the Japanese battleship "Haruna," while the Navy Department's latest release on enemy warships destroyed shows no battleships in either the "sunk" or "probably sunk" columns.

There can be no such thing as errorless reporting of war news, owing to the destruction or departure of witnesses and visual evidence, but when mistakes are made they should be corrected as soon as strategical considerations permit, for a press agent's chief stock in trade is a reputation for reliability. If, for example, the brains department came out with a blurb to the effect that, excluding Annual Numbers, this is the biggest issue of your favorite family journal in ten years and the business department said it was the biggest in fifteen years, you wouldn't believe either one. And you would be right, for actually it is the biggest issue (except for Annuals) in twenty-one years, and the biggest issue, with no exceptions, in twelve years.

Twice as Cold

• • • A couple of weeks ago A.W.M. asked rhetorically, with no hope of getting an answer, "How cold is twice as cold as zero?" A member of the brains department said it could be figured out and that it was halfway between Fahrenheit zero and absolute zero. It sounds like forced reasoning to us but the same idea has struck 'way out in Kansas City, from which point L. W. (Security Mfg. Co.) Millis writes:

> Some certain figure is half of twice as cold. Absolute zero is 459.4 deg. below Fahrenheit zero. 459.4 divided by two equals 229.7 deg., which is therefore "twice as cold as zero."

We will save it for heated discussion in the event of a fuel shortage this winter.

Tool Steel Chart Free

• • • *If you want an extra copy or so of the tool steel selection chart in this issue (page 61) you can get one at our booth (No. B-121) in the National Metal Exposition—no charge. Or if you can't wait, send us* 10c. *in stamps, to cover postage, and we will mail you one now.*

We suppose that, as in the case of the 46-page booklet, "How to Lengthen Tool Steel Life," we will be swamped with demand for the chart, so if we run low it will have to be first come, first served.

He's in the Bessemer Game

• • • It used to be common for people to refer to their business as a game—"I am in the undertaking game," —the garbage disposal game, the gastroenterological game, and so on. But until the other day we hadn't heard the expression for years. A Pennsylvanian writes us, "Twenty years ago I was a Bessemer foreman and blower and want to get back in the game." Maybe this is the first herald of a game revival. But we hope not as we have always preferred "racket."

Bakery Blunder

• • • Tell Berna, head of the National Machine Tool Builders' Association, says that a report of the Cincinnati Milling Machine Co. to the WPB was found in the food division, apparently in the belief that the company makes flour milling equipment.

Which reminds us of the young entomologist who was much interested in moths. His mother suggested that he get a book on the subject from the local library, and the next day found him wrinkling his forehead over "Advice to Young Mothers."

Stopper

• • • "Don't shoot, Mr. Crockett. . . . I'll come down."—*Jones & Lamson Machine Co.*

The Obliging Mr. Moore

• • • "A. Moore" is the name given by a gentleman of persuasive personality, now operating in northern Ohio, who is offering your favorite family journal at bargain rates. He will accept $14 in payment of a two-year subscription, $12 or even $10, which compares favorably with our rate of a straight $8 a year. The only trouble is that money paid him never reaches us.

The receipt he uses bears the name of the Publishers Service Bureau, 428 Fifth Ave., New York City. This bureau is not listed in the telephone directory, and a registered letter addressed to it was returned as undeliverable.

Machinery Hand Book

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A check given to "A. Moore" was endorsed by "A. Yerder," so although he is faithful to the first initial "A," he may vary his last name. Our own circulation representative in Ohio is William M. Hoffman, who is utterly dependable and easily identifiable. Bill is about 5 ft. 4 in. tall, aquiline-nosed, mustached, and weighs about 120 lbs., soaking wet.

Naturally we would like to meet up with "A. Moore." If he should call on you, will you let us know?

Milkmaid

• • • Stanley Brams, your Detroit seismograph, thinks this headline from the *Detroit News* is worthy of preserving for posterity:

MICHIGAN GIRL SECOND

IN CATTLE JUDGING TEST

Puzzles

The copper in last week's bowl is 3/8-in. thick.

"A Reader" of Los Angeles is absolutely right about the Sept. 3 huntsmen-noblemen problem. Although each of the two solutions adds up to two n's and one h, the first and last classes cannot be identified, and can be either n's or h's.

A. H. Frauenthal, president of the Kaydon Engineering Corp., Muskegon, Mich., asks if we have ever run the one about the cow tied to the periphery of a circular field. We believe we have, but we don't know the answer and maybe some of the master minds will oblige:

If a farmer tethers a cow on the periphery of a circular pasture 100 ft. in diameter, with a rope long enough to permit grazing over exactly one-half the area of the field, how long is the rope?

Now Is No Time to Nurse Motors!

Don't ask your men to go easy on starting, stopping, or reversing motors.

Use your priority to get the motor that's "built to take it" . . . the *only* motor with rotor windings centrifugally cast of COPPER . . . the Fairbanks-Morse Motor. It will speed production now and serve you better in years to come.

Ask for a demonstration . . . a chance to compare F-M and any other motor construction, point by point. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Illinois.

Copperspun

FAIRBANKS-MORSE

MOTORS
DIESELS
SCALES
PUMPS

Dear Editor:

PRIORITY GUIDE

Sir:

Will you be so kind as to send us the Priorities Guide dated June 4, 1942, and the publication entitled, "How to Operate Under PRP."

M. M. SAWYER,
Asst. Sales Manager
Atlas Tack Corp.,
Fairhaven, Mass.

• Mailed, but see next week's issue for a complete new Priority Guide, containing all the latest changes.—Ed.

MACHINE TOOL BOOK

Sir:

I am looking for a book showing the various types of machine tools. Do you know of any?

L. L. SHULER
Schenectady, N. Y.

• Professor O. W. Boston's "Metal Processing" should do. Price is $5; publisher is John Wiley & Sons, 440 Fourth Ave., New York.—Ed.

PLASTER MOLDS

Sir:

Will you please send me a reprint of "Plaster Molds," by W. A. Phair, published in your Oct. 9, 1941, issue.

M. R. FRAZIER
Wright Aeronautical Corp.,
Paterson, N. J.

TIPPED H.S.S. TOOLS

Sir:

Please forward 25 reprints of the article entitled "Tipped High Speed Steel Tools," by Leo J. St. Clair, which appeared in the Aug. 6 issue.

EDITH R. ANTHONY,
Librarian
Central Library,
Westinghouse Elec. & Mfg. Co.,
East Pittsburgh

ARC WELDING

Sir:

Please send us three copies of the article, "Helium Shielded Arc Welding," by H. V. Pavlecka, in the September 17 issue. I want to make them available to other members of our organization.

JAMES A. BRYSON,
Metallurgist
Burgess-Parr Co.,
Geneva, Illinois

CUTTING TOOLS

Sir:

In a pamphlet entitled "How to Increase Cutting Tool Life" there is an article "Fine Tool Finish," by Carl J. Wiberg and Wesley K. Heath.

It is such an informative and instructive article that I am wondering if it would be possible for us to purchase six copies of the article.

It would be most appreciated by the Sangamo Electric and myself, if you are in a position to grant this request. Kindly let us know the requirements for obtaining this article.

JOHN A. MUIR,
General Supt.
Sangamo Electric Co.,
Springfield, Ill.

• Certainly. Price is 35c each.

MUNITIONS BOOK

Sir:

Please send two copies of the 126-page book "Munitions and Ordnance Manufacture" at $1 each.

HUGO E. JOHNSON,
Development Engineer
Carnegie-Illinois Steel Corp.,
Pittsburgh, Pa.

STEEL EXTRAS

Sir:

Please mail to the undersigned your book of various steel extras, if you are now publishing same as heretofore, and mail your invoice for same to me.

ROBERT HUFF,
Purchasing Agent
United States Marine Corp.,
Cherrypoint, N. C.

• We have never published a book of steel extras. Try the steel companies.

WALL JOURNAL

Sir:

Would you be so good as to give us permission to reproduce some of the cartoons which you publish by Ray Thompson.

We are producing what is known as a wall journal which consists of news items of general interest to our Works Staff and which are all nicely displayed in a glass case. The contents of this case are changed about every two weeks and we should like to reproduce some of these cartoons from time to time. This wall journal is a sort of war-time expedient for a house magazine but owing to shortage of paper we cannot possibly carry out anything so ambitious until after the war. The wall journal is, as you will see, entirely for private distribution and is displayed in our factories, district offices, etc.

L. O. SHRUBSOLE
Broadway Engineering Co. Ltd.,
London

• Granted.—Ed.

BLAST MOISTURE

Sir:

In the July 30, issue, you catalogued the various plants, and their capacities for eliminating moisture. In Canada, stacks operate at —35°F. with a very low humidity. In India, in the rainy reason, the humidity may be as high as 18 grains per cu. ft. of blast. Low humidity may have just as bad an effect as high humidity. A plot of the weight of each cast and the gains of moisture per cu, ft. at an Ohio River stack making basic pig from large ores with by-product coke. during the last five days of March. shows that with a blast moisture of more than five grains per cu. ft. this stack with the burden carried would have made at least 25% more pig iron than it produced with natural humidity. A different burden and a different coke would have changed the blast moisture requirements.

Prof. W. A. Bone in his investigations, has found that the hydrogen acts as a catalyst in promoting the reduction of metallic oxides and at the same time acts as an inhibitor in reducing the quantity of carbon deposited in the upper part of the stack, and that an excess or a deficiency in the amount of hydrogen was undesirable. His investigations have been published in the Journal of the British Iron and Steel Institute.

A. DENISON WILLIAMS
Philadelphia

RAIL REMOVER

Sir:

In your June 11 issue, page 98. appeared a photograph of a device for lifting trolley rails embedded in brick and asphalt pavement.

Can you tell us if this device is now being produced commercially or to whom we should write in order to secure further information concerning it?

L. D. GREENE,
Asst. Purchasing Agent
Bethlehem Steel Co., Inc.,
Bethlehem, Pa.

• Write to the Victory Rail Remover Corp., Lincoln - Liberty Bldg., Philadelphia, Pa.—Ed.

STEEL SHELL HARDNESS

Sir:

In your May 21, 1942, issue you have a very interesting and helpful article on Cartridge Brass Hardness Conversion Table prepared by the American Society for Testing Materials.

In the article it was stated that the Society is preparing a similar table for steel as quickly as possible. We are especially interested in whether or not such a table has been prepared for steel cartridge cases.

LOUIS RAGUE,
Plating Engineer
Stant Mfg. Co.,
Connersville, Ind.

• No hardness conversion table for steel cartridge cases is available at the moment, but we believe that the A.S.T.M. will have one ready in the next month or so. Better write to A.S.T.M. at 260 South Broad St., Philadelphia, Pa.—Ed.

A BETTER-THAN-EVER TOMORROW

AMERICA'S might has re-asserted itself in the necessarily ruthless terms of today . . . in terms of more guns, better guns, ships, tanks, planes and the host of other articles of military equipment. American industry is producing these things as no other nation can—and that display of industrial supremacy not only portends the final victory for our country in the present conflict, but foreshadows a future of unprecedented progress and plenty.

It is not necessary for the individual industry to look beyond its own gates for evidence of this. Transue, with its extensive facilities for designing and producing steel stampings entirely devoted to war production, is only a minute factor in that vast scheme of things. Yet, vital war requirements have given impetus to production accomplishments at Transue that will mean better, lower cost pressed steel parts for manufacturers in the peacetime future. Multiply Transue's experience by practically every plant in every field and you have the foundation for America's brilliant tomorrow of more things for more people.

TRANSUE & WILLIAMS

Designers and Makers of Deep Drawn Stampings

ALLIANCE - OHIO

SALES OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, DETROIT, INDIANAPOLIS, CLEVELAND

THROW YOUR SCRAP INTO THE FIGHT

This Industrial Week . . .

- **Newspapers Speed Up Home Scrap Drive**
- **Steel Quota Plan Likely by Jan. 1**
- **Hook Favors British Priority Setup**
- **WPB Adopts New Material Control Rules**
- **Ingot Output Gains a Point to 99 Per Cent**

OBSERVERS who have been lukewarm over probable results of the national campaign to collect iron and steel scrap from homes this week were slowly being forced to take a new view of the scrap situation. Apparently the influence of the newspapers, which are throwing themselves behind the scrap drive, with sometimes spectacular results, is to be a dominant factor this winter in the building of scrap piles.

In some sections of the country so much scrap is being found by the public that problems of transporting, sorting and cutting it to steel mill sizes are developing. Labor shortages in scrap yards—a problem for which enterprising newspapers in some cities might help to find a solution—may act as a curb on prompt processing of the material.

Success of the scrap campaign requires maintenance of the public's confidence by quick handling of the scrap as it is offered. If the home scrap is promptly hauled away, a continued flow of old metal is likely to prove again that the U. S. has been for years the world's prime user of metal products.

Reports from mill centers are that the scrap piled up in the national campaign has not yet reached mills in quantities sufficient to prevent what can develop into a very serious situation. Enthusiasm being generated by the hunt for home scrap is stimulating the search for industrial scrap, the source of the larger tonnages. Seventy thousand industrial companies will be asked by the WPB between Oct. 1 and Dec. 31 to dig out the dormant scrap from their own plant properties to help reach the goal of 17 million tons which the combined home and industrial scrap drives must reach by Dec. 31.

Home scrap collection has its bad points—such as the effect on open hearth furnaces of charging such materials. Mills are striving to overcome this.

ON the priority front the metal working industry is finding, at Washington, the wind does blow in opposite directions at the same time. Information about priorities—by which the sequence of production and delivery of materials and equipment to war plants is established—falls into two classes. One class deals with the orders and regulations which are actually in effect now. The second class of news deals with what may happen to the Priorities System and concerns new plans, changes in these new plans and frequently the "abandonment" of new plans before they are adopted.

Frequently industry gets priority developments which are only in the planning or talk stage confused with the regulations which, however inefficient, are in effect now. Such confusion is one of the most irritating obstacles faced by American industry in this war.

Still in the talk stage, but highly important to steel producers and consumers because of the apparent failure of the Production Requirements Plan, is the Reese Taylor Plan approved by Bernard M. Baruch for steel production and distribution control. The finishing touches were placed on this plan last week when WPB officials, steel advisers and others met at Washington to study some features of the British Priorities System.

A good guess on the Taylor Plan is that it cannot go into effect before Jan. 1, hence industry must continue its struggle to understand and conform to the Priorities System, good or bad, as it is today.

AMERICAN steel men who recently visited England returned impressed with the British priority setup which hinges on the use of long range programs with specific tonnages of steel allotted as soon as a program is completed. (One reason for the trip of the American steel mission to England was to study the British system "for control of steel production, allocation and distribution." Other reasons: to determine what steel products can best be made in the U. S. and in Britain, to decide which theaters of war should be supplied from Britain and which from the U. S. to save ship space.)

Most traces of the Priority System have been knocked out of the Taylor plan (this is still in the "talking" class of priority developments) particularly the features where orders were to be assigned A, C, D or X rating. With total production and distribution under control, and requirements approved by a special requirements board, the issuance of any certificate having a semblance of a preference rating would seem to be superfluous. Under the new revised steel plan, steel companies would be required to accept orders up to 110 per cent of their quotas for a given product in any given month. Basically the steel Quota Plan bal-

ances, quarter by quarter, actual steel consumption against the known ability of mills to produce steel.

Charles R. Hook, chairman of the American Steel Commission, this week told THE IRON AGE he believes that some of the methods which the British are using in regard to distribution of products, undoubtedly would prove valuable if adopted by the U. S.

The American Steel Commission's bulky report on steel has been given to the combined Resources and Production Board in Washington. Details of the report may soon be released for publication. Members of the commission were impressed particularly with the work of women in Britain. They are running large cranes in rolling mills, driving locomotives and sorting scrap. In many jobs they are doing work now regarded as too heavy for U. S. women.

Just as though it were starting out to distribute materials for the first time, the WPB has planned a completely new organizational setup to handle the fourth quarter material control program. In general—this one seems to fit under the "actually in effect" classification, the plan provides for a system of authorizations to industry to purchase specific quantities of materials premised primarily on the information forthcoming from PD-25A applications, followed up by interim allocations. The program, THE IRON AGE is told, provides that the WPB Priorities Division will assume the responsibility of developing general procedures and establishing standards for the processing of all PD-25A applications. New rules for PD-25A routing, requirements committee and ANMB functions and duties, setting up material accounting methods within the WPB branches, and the control of PD-25A's within the branches have been established.

See page 165 for details on the revised material control program.

Industry, plagued by political plans for its control and betterment, faces concentration—limiting of production of given items to a few plants. Turn back to page 114 for this story from Washington.

Coming Next Week a New Guide to Wartime Controls

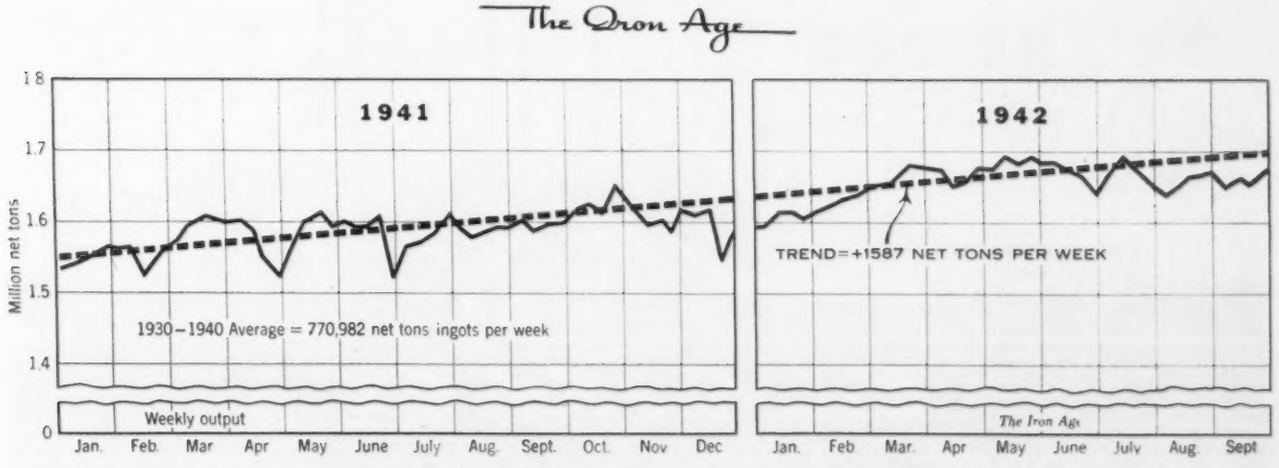
• • • Next week's issue of THE IRON AGE will include the seventh edition of The Iron Age Priorities Guide, which has now rounded out a year of service in endeavoring to make the U. S. Priority System understandable to the munitions industry and (wherever you are) to the civilian product industry.

Much new material appears in the new Priorities Guide which makes obsolete all earlier issues. Extra copies of the Guide are, as always, available to interested Iron Age readers at these rates: One to 10 copies, 50c. each; 11 to 100 copies, 40c. each; 101 to 300 copies, 35c. each, and 300 or more copies, 30c. each. Advance orders are being taken (1) by wire, (2) by telephone, (3) by letter or (4) by a call at an Iron Age office.

STEEL production in the U. S. increased this week to 99 per cent from 98 per cent last week, partly because Pittsburgh output rose a half point to 99.5 per cent and Youngstown operations climbed a full point to 96 per cent. Other districts showing gains are Southern Ohio River, four points to 105 per cent and St. Louis, three points to 107 per cent. Steelmaking in Cleveland declined two points to 94 per cent, in Detroit three points to 106 per cent. Output is unchanged at Chicago, Birmingham, Buffalo, Philadelphia and Wheeling.

At Birmingham, 70 AFL workmen on an Army road project were ordered reclassified by their draft boards. In Canada, a Manpower Priority System is being set up for labor. West Coast plane plants were told that they would lose still more of their employees to the Army, and must hire more women.

Turn to page 200 for THE IRON AGE weekly roundup of labor developments.



Steel Ingot Production by Districts Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	S.Ohio River	West	St. Louis	East	Aggregate
September 24	99.0	102.5	95.0	93.0	96.0	104.5	87.0	98.0	109.0	101.0	102.0	104.0*	109.0	98.0
October 1	99.5	102.5	96.0	93.0	94.0	104.5	87.0	98.0	106.0	105.0	102.0	107.0	106.0	99.0

* Revised

Hook Favors United Kingdom Steel Priorities

Middletown, Ohio

• • • **Unwilling to reveal** any conclusions in the report of the American steel mission to Great Britain, Charles R. Hook, president of American Rolling Mill Co. and chairman of the committee which returned recently from England, was prevailed upon to venture a few purely personal opinions in an interview here last week.

Asked whether he would be willing to express an opinion of his own as to whether the British have made good use of steel shipped from the U. S., Mr. Hook said he would be glad to reply "because I believe they have made effective use of all steel we have sent them in our combined interest, and this war is certainly a combined effort."

Undoubtedly some of the methods which the British are employing in their war effort, particularly in regard to distribution of products, would be valuable if adopted in the United States, said Mr. Hook when asked to give a strictly personal opinion on this subject. He agreed to reply to the question if not asked to be too specific, and continued to say that there were some things the mission learned that if adopted here would be extremely valuable in connection with the control of production, allocation and distribution of materials.

The mission's bulky report on steel has been made to Washington officials, and it is assumed that particular emphasis was laid on the British system of control of steel distribution. Mr. Hook, however, made it clear that any statement with respect to the findings must be made by the members of the Combined Production and Resources Board in Washington.

The marvelous work being done in industry by the women of the United Kingdom was one of the most impressive aspects of the tour, according to Mr. Hook. A fairly large per cent of the steel industry's employees are women. Women are found running large cranes in rolling mills, driving locomotives, sorting scrap, operating hot saws, and in foundries are casting, operating mold machines, making cores and cleaning castings.

"The remarkable courage and spirit of the British women must command the respect and admiration of all the world," said Mr. Hook. "It is easy to understand why this island withstood the 'blitz' and carries on so remarkably.

"You asked me what I think of the attitude and work of labor in Great Britain and I am very happy to say that when you realize the handicaps under which they are working, I feel they deserve high tribute. Strikes are so rare that it is hardly worth referring to this phase of British activities.

"I think British management has done a most excellent job and when you stop to think of what they have accomplished in the airplane industry and many others, it is nothing short of remarkable."

The mission included, in addition to Mr. Hook, Lieut.-Col. Paul P. Llewellyn; Capt. G. A. Duncan; David Scoll, representing the Maritime Commission; Paul F. Schucker of WPB; Walter Tower, president

BRITISH VISIT WILLOW RUN: Touring American plane plants, the British aircraft mission spent an interesting day last week at the Ford aircraft engine and Willow Run bomber plants, guided by Edsel Ford and Charles E. Sorenson, Ford vice-president. Members of the party from left to right included: A. R. Smith, managing director, Ford Motor Co. of England; J. D. North, representing the Fleet Air Arm; Mr. Sorenson; Sir Charles Bruce-Gardner, chairman of the Society of British Aircraft Constructors; Alex Dunbar, British aircraft production chief; S. D. Davies, builder of the Lancaster bomber; W. C. Devereaux, chairman, High Alloys, Ltd.; Merrill C. Meigs, chief of the Aircraft Section, WPB; Col. Hollingsworth S. Gregory (Army) and Lieut. Commander H. F. Sanderson (Navy); Mr. Ford; H. C. Doss, Ford general sales manager; and Lieut. Col. Harley Jones, of the U. S. Air Corps.

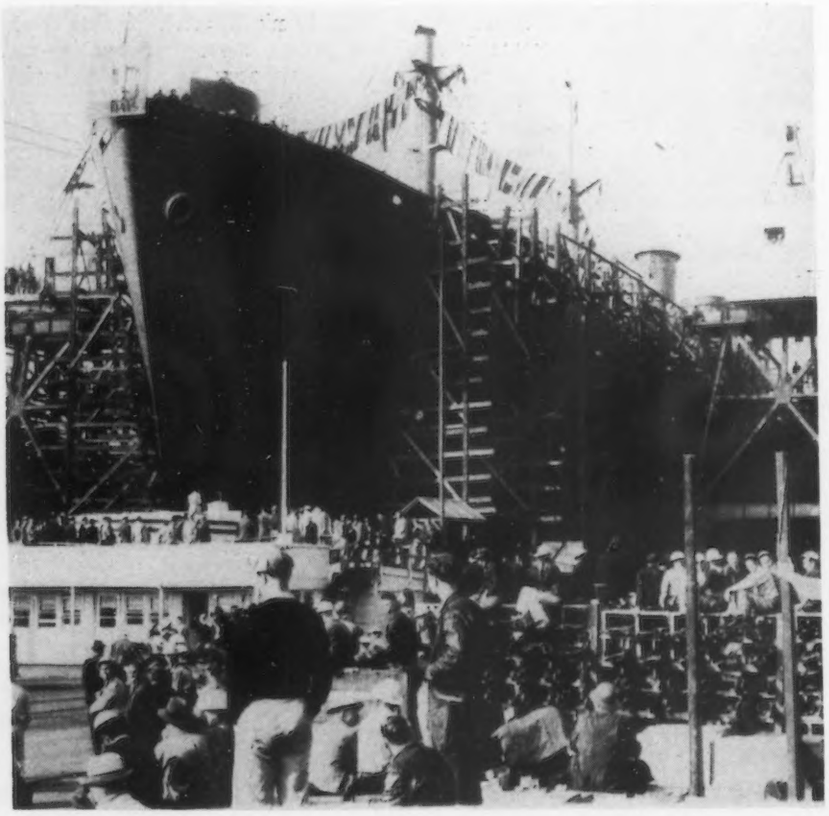
of the American Iron and Steel Institute, and Earl C. Smith, chief metallurgist of Republic Steel Corp. Accompanying the official members were Philip Sandmaier, steel expert associated with the Maritime Commission; Neele Stearns, of Inland Steel Co.; A. R. Edwards, who represented Armco in England until Dunkirk; John C. Murray of Jones & Laughlin Steel Corp., and Frank Ragland of the Institute who acted as secretary of the mission.

At the time the mission left the United States its purposes were announced as including the following studies:

1. Ways to increase total production of steel in the United States and Great Britain.
2. The British system for control of steel production, allocation and distribution.
3. How the steel programs of the two nations can be brought into better balance so that plates, shapes, structural steel and so on will all be produced in the proper ratio.
4. Whether increased production and savings in shipping space can be effected by sending more ingot steel and less finished weapons to Britain or vice versa.
5. What steel products can best be made in the United States and what can best be made in Britain.
6. Which theaters of war should be supplied from Britain and which from the United States to economize on shipping space.
7. Methods used by Britain to collect steel scrap and the use that is made of the scrap.
8. British progress in reducing steel consumption by substitution, simplifying specifications and eliminating wasteful machining operations and means for pooling such information by the two countries.
9. What percentage of British steel production is used, respectively, in war and civilian production.
10. Means of obtaining savings in the use of scarce alloy steels.

10 DAY WONDER: Right before your eyes is the Joseph T. Neal, Henry Kaiser's latest success—a complete hull equipped to the point that steam was up in the boilers at the launching—shown ready for launching just ten days after the keel was laid. This slices 14 days off the previous record and sets an all-time record for the world. During World War I similar construction required 212 days. (Less than four days were needed to outfit this ship.)

Press Assoc. Inc. Photo



Coordinated U. S.-British Priority System Forecast

Pittsburgh

• • • **Although no official** report of the American Steel mission which recently returned from England has been made public as yet, it is expected to have a "good report" and will include such things as a coordination of the priority systems of the two countries towards affecting a better allocation of critical war materials and will probably result in standardization and correlation of the production of the two countries.

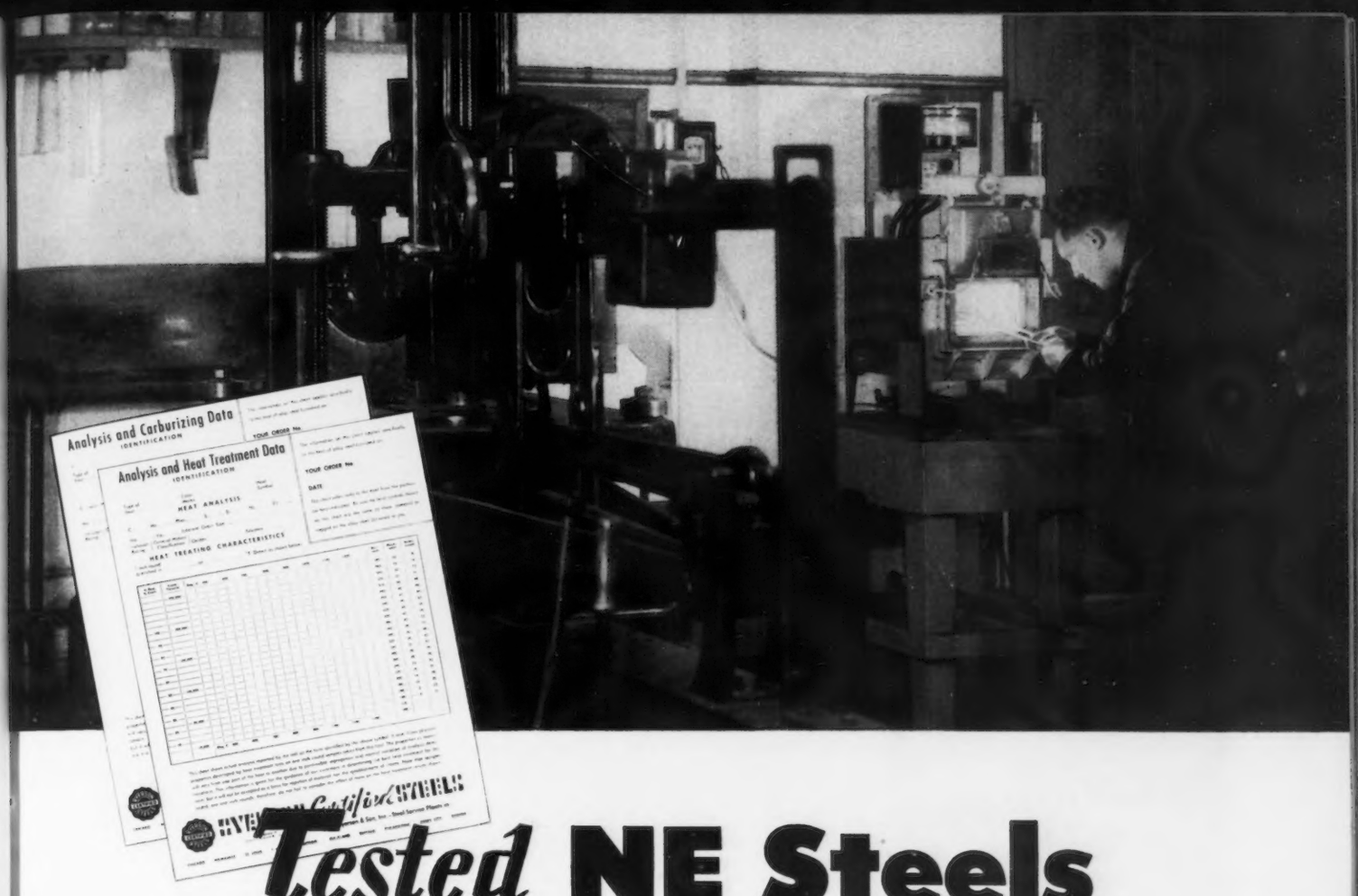
The above conclusions were drawn by Sir Robert Sinclair, deputy for the combined production and resources committee of the United States and Great Britain and a representative of Capt. Oliver Lyttleton, English Minister of Production.

The high official of British war production was in Pittsburgh last week inspecting the area's steel mill operations. According to him, the local mills have "more speed, much more space, and better equipment" than is found in England. The inspection tour was made with J. S. Knowlson, vice chairman, WPB, and a deputy on the combined British American Production Board. Plants covered were part of the Pittsburgh works of Jones & Laughlin Steel Corp. and the Irvin and Homestead works of Carnegie-Illinois Steel Corp.

British Steel Controls Require More Exact Data

• • • **The British method** of controlling steel distribution puts emphasis on specific amounts of material needed for specific purposes, data on file at the British library in New York disclose. Procurements, contractors and subcontractors are required to estimate their steel needs closely before they are given authority to purchase the steel.

Under the British Iron and Steel Control's simplified system for distribution of steel, users engaged in war production obtain from the government a symbol distinguishing the exact purpose of a particular job. Having obtained this authority for a given quantity of finished steel for a specific pur-



Tested NE Steels
Now in Ryerson Stock

Specific Heat Treatment Data With Every Shipment

NOW available from Ryerson stock—tested NE (National Emergency) Alloy Steels. All alloys are tested in the Ryerson laboratory. Samples are heat treated to determine their heat treatment response. The chemical and physical properties as well as the result of Ryerson tests are shown on an easily read chart. Each shipment of alloys is accompanied by a copy of the chart for that particular steel. Stamped heat symbols and color marking positively identify all bars with their proper data chart. Both steel and data charts arrive together.

NE Steels, as you know, are "lean alloys" created by America's top metallurgists to save critical alloying elements. However, surprisingly good results have been secured from them by manufacturers in many lines.

While Ryerson stocks include a number of different analyses of the NE Steels—the demand has been such that it is impossible to keep all sizes on hand. Naturally, these steels are being distributed in keeping with the war production effort.

Ryerson probably can help you in adapting NE Steels to your present production. Our experience of a century in solving steel problems will prove of value. You'll find Ryerson Steel-Service men are easy to work with and prompt in their cooperation. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON STEEL-SERVICE

pose, the user places his order with the mill or the steel seller.

The quantity of steel supplied against such orders is then debited against the quota of steel allotted to the authorizing department. In this way, the total quantity of steel which can be produced quarter by quarter is distributed according to the degree of urgency in each case, at the same time avoiding the bottlenecks of indiscriminate ordering.

The amount of steel entering into tooling-up requirements may be included in the total, or may be figured separately.

In contrast to the British system, United States military procurement officials have lacked exact data on the amount of steel required in specific war production jobs, item by item. Such information, difficult to obtain in the short space of time since the U. S. entered the war, is being assembled as rapidly as possible.

Over-ordering and the piling up of excess stocks were sources of complaint in England as late as last May, however, despite the system evolved earlier than that by the Iron and Steel Control. It was expected that a new order would be put through forcing the ordering of minimum requirements for a job instead of maximum requirements.

In England separate authorizations are not required for small steel orders. Manufacturers supplying such orders apply to the Board of Trade or Ministry of Works and Buildings for bulk authorization covering iron and steel needs. These bulk authorizations are to be used for execution of small orders. The quantity of materials available for bulk authorization is limited.

Contractors engaged in prime war production when they place subcontracts are required to get from the subcontractor estimated tonnages of finished steel required to meet specific delivery dates.

EMPTIES: Hundreds of empty shell casings on this U. S. cruiser's deck tell a graphic story of a bombardment of Japanese-held Kiska island, in the Aleutians. *Press Association photo*

No Place for Amateurs in War Effort, Knowlson Says

Pittsburgh

• • • **There is a growing** appreciation of the fact that the present war effort is a business in which the best professional talent is required, J. S. Knowlson, vice chairman, WPB, told more than 1000 Iron & Steel Engineers here last week at the Association's annual dinner. He urged industrialists to "let us all pledge ourselves from now on out to business as usual and make our business as usual the business of total war." In describing orders with super ratings, Mr. Knowlson said, "AA-1 and AA-2 orders, and there are lots of them, are for items required for the fighting forces in the next few months . . . AA-2-X and lower are for materials necessary to keep plants going, the transportation system moving, and the operation of communications, etc. . . . AA-3 and AA-4 orders include those involving materials for the construction of plants, for the production of synthetic rubber, plants for high octane gas, shell loading programs, etc."

Mr. Knowlson warned that within a short time labor will present a problem as serious as the raw material shortage and said the WPB is working closely with the War Manpower Commission to determine which industries should have first call on workers.

Press Assoc. Inc. Photo

COMING AT YOU: This is how a fighter plane looks coming right at you to make a landing on the new aircraft carrier U.S.S. Charger. This view was made from the carrier's fan tail looking aft over a 5 in. gun.

Inland Mill Sets New Mark

Chicago

• • • **The record shipping** mark established in July by the 76-in. hot strip mill of Inland Steel Co.'s Indiana Harbor plant was topped in August and a new all-high mark set for the mill, officials of the company report. The mill's net tonnage exceeded by 0.15 per cent the July shipping high, an increase of 178.9 per cent over the monthly average plate shipments in pre-Pearl Harbor days.

LATROBE

★ THE ★ VICTORY ★ HIGH ★ SPEED ★ STEEL ★

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

- ★ Effects urgent savings in Tungsten, Molybdenum and Vanadium.
- ★ The superior Tungsten-Molybdenum high speed steel for all industrial cutting operations.
- ★ Can be readily heat-treated to attain maximum efficiency.

Write for Bulletin

LESCO

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT ·· LATROBE · PENNSYLVANIA

CRITICAL MATERIALS CONSERVED: The Ready-Power Co., Detroit, faced with the need for much critical material to build enlarged manufacturing facilities, solved the problem by building wooden buildings. Shown here is a panorama of the new power plant division.

Canada Issues Order Stopping Steel Hoarding

Toronto

• • • **To prevent** the hoarding of steel by Canadian manufacturers, F. B. Kilbourn, Steel Controller, has issued a new order which provides that additional deliveries of this metal be made only when stocks on hand are below the quantity required for production in a three-month period. The order affects steel used in every type of product from ship's plate to nails. It restricts warehouse supplies to a three-month inventory and supplies for retailers, garages, blacksmiths, tinsmiths, plumbers and wheelwrights to one-month inventory. The order prohibits the use of steel for non-essential purposes. It is now illegal to use steel in a hobby shop, for non-essential farm fencing, or for roofing. Steel may be purchased, however, for the following purposes:

1. The provision of fences and other devices for safety, and of all articles necessary for the protection of health and life.
2. The construction of homes or shelters.
3. The provision of facilities for the production, transportation, merchandising, protection, and storage of foodstuffs, fuel and clothing.
4. The necessary maintenance or repair of any plant, machinery or equipment.
5. The pursuit of a regular occupation by which a person makes his livelihood.

To Produce Wings

Detroit

• • • **Hudson Motor Car Co.** has obtained a new aircraft contract, one of its largest to date, to produce wings for the Curtiss-Wright "Helldiver" dive bomber.

Tank Armor Plate Plant Under Way At Chicago

Chicago

• • • **Carnegie-Illinois Steel Corp.** is building a tank armor plate plant which will be producing early in 1943 to supply shaped armor to midwestern tank arsenals, Irving S. Olds, U. S. Steel Corp., chairman, announced here.

Mr. Olds and other directors of U. S. Steel were in Chicago for the first board meeting to be held outside New York City since the corporation was founded.

Tubular Alloy Steel Corp., a new subsidiary, has acquired the plant of National Tube Co. at Gary, Ind., and will manufacture alloy and stainless tubing for aircraft structures, motor parts, bearings, tank tractor tubing and oil refinery tubing, the U. S. Steel chairman said. The work of installing machinery and equipment is now in progress. Tube reducing machines, key equipment for the production of aircraft tubing, have been installed and immediately placed in operation without waiting for the installation of the remaining machines.

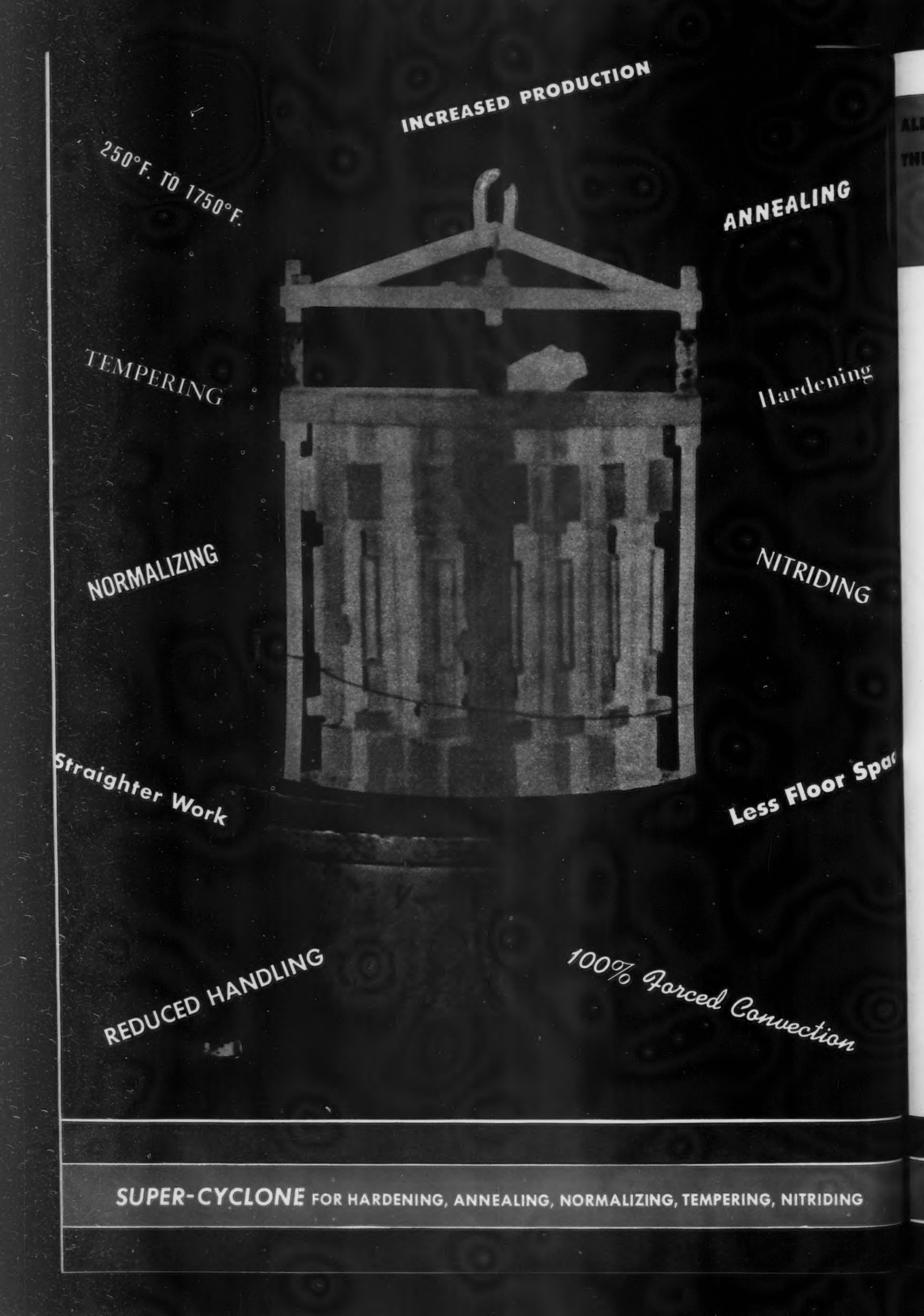
American Steel & Wire Co. last year announced plans for rehabilitation and expansion of its facilities in this district, including a new coarse red mill and a new mill for the manufacture of merchant products at Joliet, and various improvements in its facilities at Waukegan. This program is well under way. Some units installed at Waukegan are already in operation. Others at Joliet will be in operation by the first of the year. It is expected that the project will be completed and producing to aid the war effort during the first half of 1943.

Carnegie-Illinois Steel Corp., in addition to constructing the tank armor plate plant, has been active in expanding its facilities in the Chicago area for steel production. This program involves an expenditure of more than $67 million. Major items include projects at the South Chicago Steel Works, Gary Steel Works, and Gary Sheet & Tin Mills.

Work of rebuilding twelve soaking pits at the Gary works is practically completed. One coke oven battery was rebuilt and resumed operations last month. Another which is being rebuilt will resume operations about Dec. 1. A new battery of coke ovens, being built for account of the Defense Plant Corp., will be completed early next year. A program for increasing facilities to provide slabs for the new armor plate plant is well advanced.

The South Chicago Works of Carnegie-Illinois is United States Steel's manufacturing center for electric furnace steels, which are used extensively in aircraft construction. Existing electric furnace facilities are being increased by the installation of an additional furnace and additional finishing facilities. Two electric furnaces were placed in operation in 1941.

At Gary sheet and tin mills, the installation of additional electrolytic tinning lines and equipment for chemical pretreatment of black plate is well along and will be completed during 1943. These new units will aid in conserving the nation's supply of pig tin.



SUPER-CYCLONE FOR HARDENING, ANNEALING, NORMALIZING, TEMPERING, NITRIDING

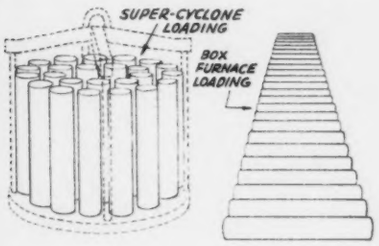
ALL THE ADVANTAGES OF 100% FORCED CONVECTION HEATING IN THE HARDENING, NORMALIZING AND ANNEALING RANGE WITH THE

LINDBERG SUPER-CYCLONE

The first furnace of its kind, employing 100% forced convection heating with a temperature range from 250° F. to 1750° F., the Lindberg developed Super-Cyclone is an ideal furnace for hardening, normalizing, annealing, tempering or nitriding. As a result of the 100% forced convection heating principle, production is increased, distortion minimized, material handling is reduced and less floor space is required to handle the same or increased production over conventional equipment.

INCREASED PRODUCTION

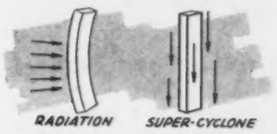
"Worm gear hardening *3 times greater* . . . bearing race hardening *7 times greater* . . . gray iron casting annealing *12 times greater.*" You can figure



the Super-Cyclone's production possibilities in your own shop by spreading an average load of parts on the floor, one layer thick, as handled in a radiation type box furnace. Measure the area required. Take another load of the same parts and stack them up in a 36" circle, 4' high, making allowance for spacers and supports. Figure it will take a maximum of 3 hours to heat the load and 5 minutes to quench the lot. Ordinarily you will find, by comparison with the laid out parts, that the Super-Cyclone will handle larger loads in the same or less time with a consequent increase in production, in some cases as high as 1200%.

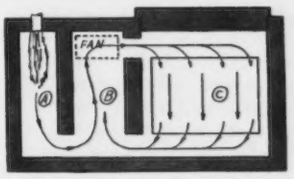
KEEPS WORK STRAIGHTER

"Worm gear straightening was reduced from 85 out of 100 to 10 out of 100, thus saving 7½ hours straightening time per 100 worm gears." Rings that were previously heated and quenched



individually on special jigs to hold them round, are now heated in a Super-Cyclone and quenched, 63 at a time without jigs, and held well within the acceptable range of .010".

The 100% forced convection heating principle of the Super-Cyclone heats the work rapidly and uniformly by driving heated air through the charge at high velocity. The heat source is confined to a separate chamber (A) away from the work (C) and separated by the fan chamber (B), thus



preventing radiant heat of a source hotter than the desired work temperature from striking the charge and causing distortion. As a result, valuable man hours are saved from the straightening press and made available for other work.

REDUCED HANDLING

The use of a fixture in the Super-Cyclone eliminates the individual handling of pieces throughout the heat treating process. The parts are loaded onto the fixture and remain there during the heating, quenching and tempering stages, and too, in reducing distortion to a minimum, the Super-Cyclone eliminates extra handling of work for straightening.

LESS FLOOR SPACE

Based on averages of what the Super-Cyclone has done in other plants, you can figure that it will require not more than ⅓rd the floor area demanded by conventional equipment to handle the same or greatly increased production. In one plant alone, *a Super-Cyclone replaced 8 box type furnaces and turned out twice as much work!*

The Super-Cyclone's efficiency of operation, savings in man hours through the reduction of handling time and distortion, and economy of floor space, makes it an ideal production unit for the large or small shop.

The Super-Cyclone is made in a wide range of sizes from 16" diameter by 20" deep to 72" diameter by 84" deep. Most are gas fired although a number are available electrically heated.

Write today for Bulletin 130 or ask to have the Super-Cyclone explained to you at the Lindberg Booth, National Metals Congress, Cleveland, October 12 through 16.

LINDBERG ENGINEERING COMPANY

2452 WEST HUBBARD STREET • CHICAGO

CYCLONE FOR LOW-COST ACCURATE TEMPERING

LINDBERG FURNACES

HYDRYZING FOR SCALE-FREE AND DECARB-FREE HARDENING

Delta Shipbuilding Gets 15 Liberty Ship Contract

Washington

• • • **The construction of** 15 additional Liberty ships will be begun shortly by the Delta Shipbuilding Co., Inc., New Orleans, it was announced by the Maritime Commission on Thursday. More than 42,500 tons of steel will go into the ships under the contract awarded.

The company, which was already under contract to build 61 cargo ships of the Liberty type before the end of 1942, will deliver the additional vessels in the last three months of next year. The Maritime Commission's ship program, which will produce 2300 new ships by the end of next year, includes more than 1600 Liberty ships.

Wide-World Photo

CHERCHEZ LA FEMME: Marie Whitmore, with the shapely nylon pegs, proves to be more of a work stopper than a worker on this wing job. Slacks might prevent such a problem from developing. (Photo was especially posed at Douglas Aircraft.)

Small Plants Recently Given $6 Million in War Contracts

• • • **Approximately six million** dollars worth of war contracts have gone to small business in the past fortnight through the efforts of WPB's Smaller War Plants division. As an example of the division's efforts, it is reported that about two weeks ago the Chemical Warfare Service was about to place orders for a large number of incendiary bombs of an entirely new type. Since production required complete new tooling, the division persuaded the Army to place the orders with firms which had never done this sort of work.

Speeding Victory

AT IT'S SOURCE

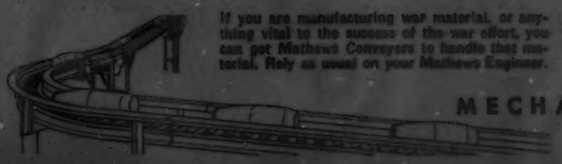
● **TIME WAS NEVER MORE PRECIOUS** than in this national emergency. Every step that can be saved . . . every unnecessary motion that can be eliminated . . . every ounce of energy that can be conserved helps to speed the tools of victory and shorten the war.

Keeping munitions, materials, and machinery supplies moving faster and with less worker fatigue is the function of Mathews Conveyer Systems.

Mathews engineers have helped hundreds of manufacturers of war material speed up production schedules with no increase in man-and-machine hours! They are ready to work with you in your effort to increase your production.

MATHEWS CONVEYER COMPANY

ELLWOOD CITY, PENNSYLVANIA



If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION

Manpower Shortage Cuts Into Coal Production

Cleveland

• • • **One mine of the** Hanna Coal Co., one of the largest coal mines in Ohio, this week cut its work week schedule from a six-day week to a five-day week because of the lack of manpower, it was announced. Formerly, the company operated five full days a week with a swing shift making up the sixth day, but operations were forced down to five days, using the swing shift to fill out the other shifts that had been riddled by draft and other war industries.

The Piney Fork Mine was the first of the Hanna mines to curtail operations, and it is likely that within a few weeks the St. Clairsville, Willow Grove, Dun Glen, and Georgetown mines, which are now shorthanded, will go on a shorter work week. The Piney Fork mine, operating six days a week shorthanded, was averaging less tonnage per day than when they were fully staffed and operating full time, so to boost daily output the work week was shortened.

Another difficulty is that at present most of the men employed are older men, and, in addition to output falling off, the accident rate in the mines is skyrocketing. As one official put it, "We are hiring anyone with two legs that looks like he can stand for a shift, and if a man with a wooden leg looks like he can stand it, we'll hire him."

Some of the hard jobs in the mines, like loaders and trip men, have always been filled by younger men, but the draft has drawn these men off, and older men are taking their place. At present, there is not a trip man employed that has been on the job for more than six months. Other mines in the area are likewise suffering from help shortages, with the U. S. Coal Co. cutting operations from two shifts per day to one shift.

Manual Issued on Women in Industry

Milwaukee

• • • Believed to be one of the first publications of its kind, a health and safety manual devoted exclusively to the problems of women in industry has been published by the Allis-Chalmers Mfg. Co.

The new manual was written and styled with the women's point of view in mind. Intermingled with the text are line drawings and photographs of women's activities in the plant.

An unusual feature is a section devoted to the proper attire for women in the shop. This section deals particularly with the new safety clothing designed by the health and safety division of the Allis-Chalmers' industrial relations department from existing slack suits for sale by national retail organizations.

In addition, the manual also treats with the proper exercises necessary for the maintenance of good physical condition. Other sections discuss hazards to be avoided in the various occupations, including office workers.

ARCOS CHROMANG ELECTRODES FOR WELDING ARMOR!

CHROMANG WELDING CHARACTERISTICS

(1) Makes it easy to meet ballistic tests
(2) Controlled arc
(3) No slag interference
(4) Arc stream is steady and well directed
(5) Weld metal washes well up on sides
(6) Chromang welds are sound
(7) High deposition rate
(8) Downhand or all position
(9) Moisture resistant package
(10) Chromang doesn't vary from lot to lot, shipments are consistently high in quality

Compare Chromang if you aren't already using it.

The Arcos laboratory and research staff have worked unceasingly to bring Chromang to its high degree of excellence. Interested metallurgists and other officials may, upon request, inspect test data.

PRODUCTION

COMPARE CHROMANG on your production line — the electrode specially developed by Arcos to meet every requirement for welding armor plate. You will find that Chromang meets ballistic requirements.

It is important to note that the high quality of Chromang welds is a combination of carefully controlled factors:

(1) The important modifying element is in the core wire
(2) Chromang coatings are not overloaded with ferro-alloys
(3) The result: An all position electrode with the speed of a downhand electrode and with superior arc characteristics — welds that are sound — welds that require no chipping out for rewelds.

Put Chromang to work on your production line — get the facts from Arcos.

ARCOS CORPORATION
401 NORTH BROAD ST., PHILADELPHIA, PA.

KINGSPORT, TENN.— *Slip-Not Belting Corp.* • LOS ANGELES, CALIF.— *Victor Equipment Co.* • MILWAUKEE, WIS.— *Machinery & Welder Corp.* • MOLINE, ILL.— *Machinery & Welder Corp.* • NEW YORK, N. Y.— *H. Boker & Co., Inc.* • OKLAHOMA CITY, OKLA.— *Hart Industrial Supply Co.* • PAMPA, TEXAS— *Hart Industrial Supply Co.* • PITTSBURGH, PA.— *Williams & Co., Inc.* • PORTLAND, OREGON— *Industrial Specialties Co.* • ROCHESTER, N. Y.— *Welding Supply Co.* • SAN FRANCISCO, CALIF.— *Victor Equipment Co.* • ST. LOUIS, MO.— *Machinery & Welder Corp.* • SYRACUSE, N. Y.— *Welding Supply Co.*

Losing the War

Assistant Navy Secretary Bard Tells U. S. How This Can Best Be Done

• • • **America's insufferable** and materialistic pride is blinding its people to the fact that the war is being lost, Ralph A. Bard said Friday at a New York meeting of shipyard union workers.

If members of the Industrial Union of Marine and Shipbuilding workers squirmed in their seats, at Bard's words, so would some businessmen have squirmed. The assistant Navy secretary was going after all classes of Americans with a bull whip.

"I see no fundamental grasp of our predicament in anti-union employers who sabotage production committees for fear that industry will be sovietized, nor in labor union leaders who are so concerned about the competitive position of their own little groups as to examine the war with regard to how their own puny fortunes will be affected if labor unity is achieved or jurisdictional lines are eradicated."

For the he-can't-mean-me American who heard or read the speech—Bard really went to town. Delivered by a still higher war leader—say the President—it might have been still more a shocker to U. S. complacency. Industry noted that Mr. Bard's warning about boasting of phony percentages—two tanks built instead of one making a 100 per cent output gain—seemed to apply best to government leaders.

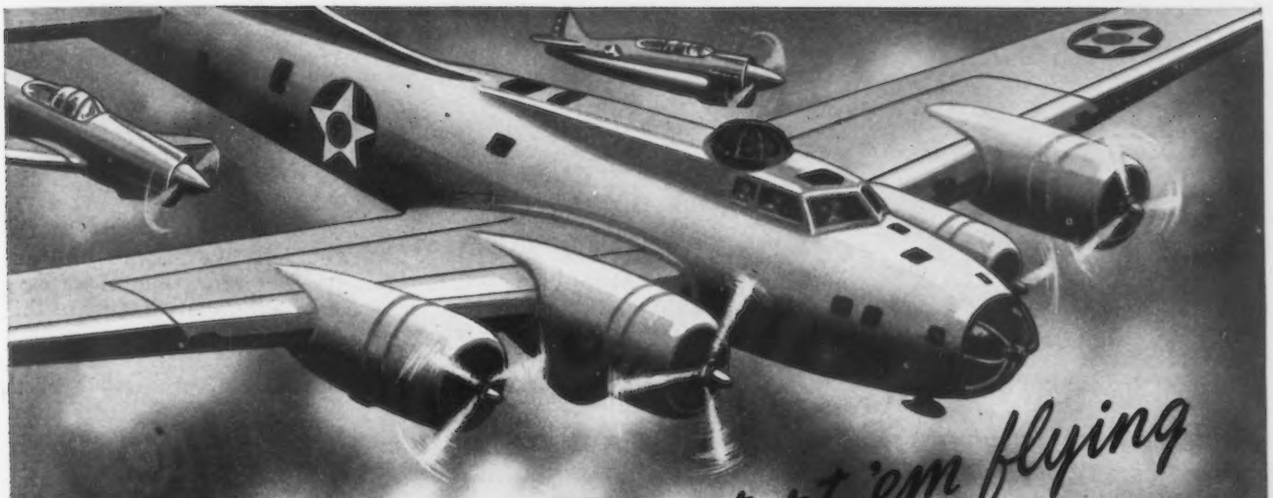
Assistant Secretary Bard's address follows:

Some months ago, after the first stunning shock of Pearl Harbor, we Americans needed a shot in the arm to restore our ego. That ego, the product of the belief that we were the peculiar children of fortune, expressed itself in the vague assumption that we could lick any of our enemies in sixty days, without skipping a full meal with dessert, or missing a Sunday drive in the country.

Flexing Our Muscles

After the unhappy realization that we had been cruelly outsmarted in the first inning of the war, in the peace and quiet of a Sunday morning, our own tradition of assuming that everything about us was the biggest and the best, furnished us with a compensatory reflex. We fell into the bumptious practice of flexing imaginary muscles, and loudly proclaimed that as soon as we had completed an intensive course at the gymnasium we would get even with our enemies. We began pointing with pride at our resources, and without a blush plunged into the amiable self-deception of using percentages. If two tanks in a 10,000-tank program rumbled out of a factory where one had before, we gloated that production was up 100 per cent.

The Japanese, diligent little fellows that they are, saw to it that we received photographs of American officers and men surrendering at Corregidor, and equally impressive photographs of seas of British faces imprisoned at Singapore. Because we had been so well schooled



Pease helps start 'em flying

Getting the planes off the drafting boards into the air, and keeping them there, takes a barrage of Blueprints . . . Blueprints are essential to translate engineers' drawings into modern implements of war.

Behind the fleets of planes, ships, tanks, jeeps and peeps, are fleets of Pease Continuous Blueprinting Machines . . . machines whose outstanding advanced features enable them to produce quality Blueprints from pen or pencil tracings up to 30 feet per minute, resulting in lowest possible per square foot cost of finished prints.

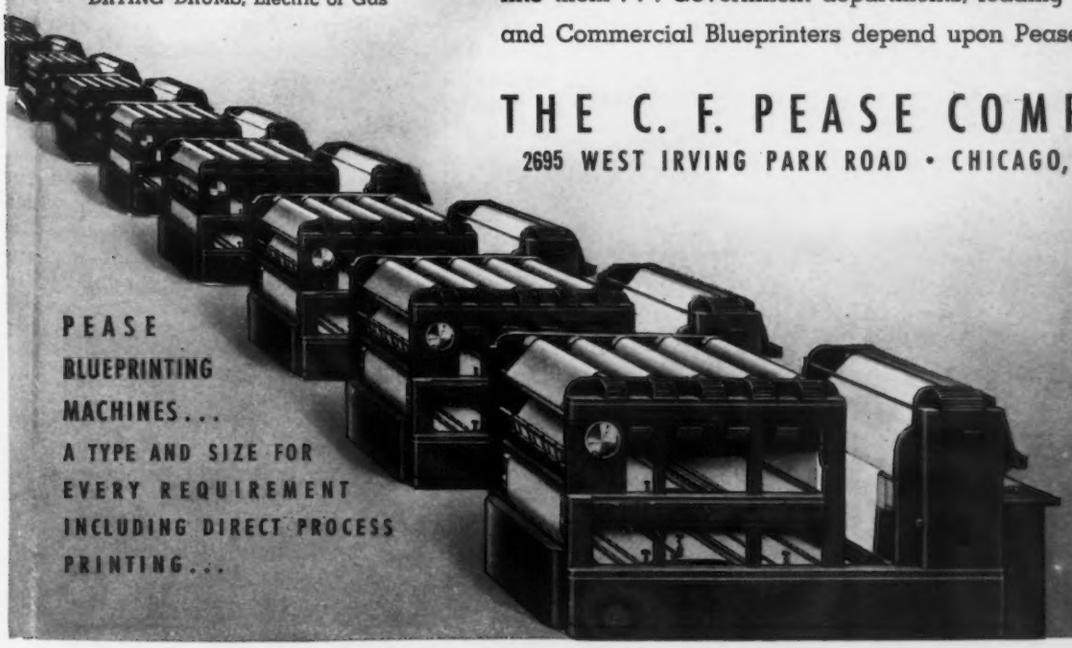
Because Pease Blueprinting Machines can do the job better, faster, and cheaper . . . and because the stamina essential to uninterrupted day-in, day-out high speed production is built into them . . . Government departments, leading industries, and Commercial Blueprinters depend upon Pease.

Pease features . . .

- ★ THREE SPEED LAMP CONTROL
- ★ SLIDING "Vacuum-Like" CONTACT
- ★ ACTINIC "No Break" ARC LAMPS
- ★ HORIZONTAL WATER WASH
- ★ QUICK CHANGE CHEMICAL APPLICATOR SYSTEM
- ★ THERMOSTAT CONTROLLED DRYING DRUMS, Electric or Gas

THE C. F. PEASE COMPANY

2695 WEST IRVING PARK ROAD • CHICAGO, ILLINOIS



PEASE BLUEPRINTING MACHINES . . .
A TYPE AND SIZE FOR EVERY REQUIREMENT INCLUDING DIRECT PROCESS PRINTING . . .

in the callous disregard of the tarnished spots in our armor, we were able collectively to avert our eyes from these unpleasant photographs and give out some more statistics about what we would do next month, or the next month, and most certainly in the months after that.

It'll Save You

President Roosevelt one fine day reminded the country that it was suffering from too much complacent optimism, and then we went in for pessimism. We government officials have told you and other groups in recent months that we could lose the war. But I suspect that our native conceit has accepted this line of thought as traditional advertising technique, the kind of message which sells hair tonic and cure-alls, full of terror in the first part of the ad and reassurance in the windup—the ads which say you are most certainly damned, but our product can save you.

It seems to me that our pre-Pearl Harbor egotism had such momentum that it is with us today in distorted and dangerous form. We go around saying "We can lose the war, but"—. We may as well admit it—every time one of us says we can lose the war we think of this as pure rhetoric, part of the old pep talk. The assumption is, of course, we can't lose the war, but scare 'em a little and then in the windup of the talk give 'em the build-up about our great American heritage of freedom and what not, and how our courage and our self-sacrifice will bring us to victory over the forces of evil—and then there will be a people's peace, and amity and justice will pervade the earth, forever after.

Time for Realism

How about, for a change, just saying that we are still losing the war. And realize that we damn well mean it.

Such realism, no doubt, would be a heart-racking plunge into cold water, but it probably will give us some idea of what we are up against.

It would remind us that not since the Civil War has this nation been called upon to suffer greatly.

It might drive us to the realization that morale is the spiritual capacity of a people to endure pain and suffering, and not a campaign of bill posters, pep talks and band concerts.

It might free us of the calmness with which we read of the ordeals of the Russian Army. All honor to them.

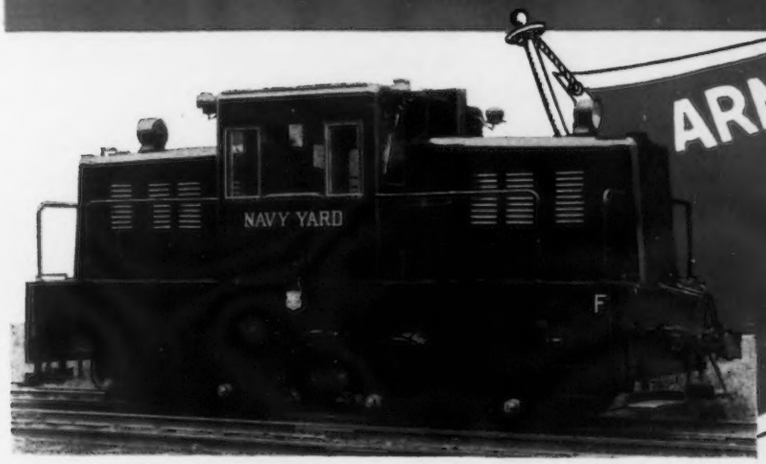
It might, in our shaken frame of mind, drive us to the Lincoln memorial in Washington, where on the north wall we could read the Second Inaugural Address, in which President Lincoln posed the disquieting proposition that perhaps the nation was being punished in those days for having enslaved a race.

No Political Clinches

Thus conditioned to the unpleasant task of self-examination, we might ponder whether or not we have tempted adversity and slavery by trading our fine-sounding concepts of the freedom and dignity of the individual for a mess of advertising slogans and political cliches.

This painful technique of realistic

Serving the ARMY and NAVY as well as INDUSTRIAL PLANTS



H. K. Porter Company was one of the first companies to receive the Army-Navy Award for high achievement in production.

A typical 50-ton Diesel Electric for Navy Yards.

One of the many Diesel Electric Locomotives supplied to the U. S. Army. Illustration shows one of 65 tons.

A 50-ton Porter Steam Locomotive designed for the U. S. Army.

H. K. Porter Company, Inc., has been building locomotives for more than 75 years. Men who know locomotive efficiency have always respected Porter engineering skill and Porter construction methods — they know that Porter locomotives move MORE tons at LESS cost.

Our fighting forces are using Porter locomotives for all types of haulage. If you are about to make the capital investment necessary in purchasing a switching locomotive let Porter engineers recommend type and size best suited to your specific needs. Only Porter builds a complete line of locomotives for industry.

Only PORTER Builds a Complete Line of Locomotives for Industry

H. K. PORTER COMPANY, INC.

PITTSBURGH PENNSYLVANIA

self-analysis might even remind us that freedom, like any other virtue, does not exist in a vacuum. It must be worked and practiced to exist at all. And like any other virtue, it imposes upon those who would have it the unpleasant tasks of discipline and sacrifice. A materialistic people do not learn these tasks by reading posters or listening to pep talks, any more than you can learn to play the violin by the same methods.

We have of course, under the stress of the war, had a spiritual rejuvenation of a kind.

But I rather feel that our spiritual revival is a little bit like that of the boy who said his prayers only when he had to sleep in a folding bed.

Picking Up the Check

We have been wrangling for months over a tax bill for 1942, which in plain language means that we have been fighting over who is going to pay how much for this catastrophe which has engulfed us. The pressure of rival enonomic groups, each armed with unassailable statistics to show how that group will suffer injustice if thus and so happens, has ebbed and flowed like the tides for ten months.

I fail to detect a spirit of sacrifice in these group gyrations before Congress. Neither does it indicate that we have a spiritual grasp of our threatening fate when we sell bonds to help finance a war of survival or extermination on the promise of profitable monetary returns on the investment. I see no fundamental grasp of our predicament in anti-union employers who sabotage production committtes for fear that industry will be sovietized, nor in labor union leaders who are so concerned about the competitive position of their own little groups as to examine the war with regard to how their own puny fortunes will be affected if labor unity is achieved or jurisdictional lines are eradicated.

Fighting a Monstrosity

I think our insufferable and materialistic pride has rendered us incapable of realizing fully that in German nazism we are fighting a monstrous thing that started out as a god-man complex, and now is fighting to the death whether that god-man complex still exists or not, in the desperate realization that Nazism and the deluded fools who are backing Nazism cannot survive if they do not win and exterminate their victims.

We would find it hard to follow through the thought that the little Japs, for whom we have always entertained a rather fond contempt, consider us foppish because we equip our aviators with parachutes. It is a degrading thought to these our enemies that there should be any alternative to defeat save violent death.

We are whistling in a graveyard to keep from facing reality. We prate about our unity of purpose. Then we retire to the woodshed with a sharp pencil and a clean shingle, to figure out whether the agricultural or the petroleum interests will grab the synthetic rubber business, and whether the

PERFORMANCE EXTRAS

in Salem War Production Furnaces

● ● ● ● This type Salem batch furnace heats ingots, billets, and slabs. It heats plain, high carbon and alloy steels equally well since the heating cycle, atmosphere, pressure, and time elements are under strict control. Scientific discharge of waste gases assures uniform heating on low firing rates. Production capacity of alloy steel exceeds 6 tons an hour at 2250° F. The chambers (9' x 16') are double and each has two doors. Only two men synchronize loading, heating, and unloading operations, providing EXTRA production with low operating costs. Salem offers all types of heat treating equipment with special performance features. Write today.

SALEM ENGINEERING COMPANY

SALEM ENGINEERING CO. • SALEM, OHIO

British-Dutch rubber cartel will be revived after the war to threaten this new industry. We hope that we can enlist the support of the masses of Latin America and our own Negroes, without having to do too much toward solving the agrarian problems of our neighbors to the south or the economic problems of our fellow-Americans. And we hope that the Russians will whip the Nazis, but not be too unreasonable about spreading their uncomfortable doctrines outside of Russia.

And all the time we have a dusty standard in the attic around which we could all rally if we would but break it out and understand its dynamic implications.

I mean the standard of democratic idealism, which means tolerance, humility, sacrifice and understanding of the meaning of human dignity. It is a standard fashioned for us long ago, in suffering and hardship, by our forefathers. We put it away and took instead the billboards which proclaimed us the strongest, greatest and most superlative people that ever put in two and got out five.

We are still flexing our imaginary muscles and shouting: "Wait till I catch that lug who hit me when I wasn't looking!"

We had better stop for a moment and look in a flat mirror, to see if our gym trunks fit us.

At this point I should shift gears and wind up with predictions of a glorious finish of our uphill fight.

But I'm not going to do it.

We are still losing this war, period. And we should damn well understand it, period.

It will take all we've got to win—what are you going to do about it?

LINCOLN JEEPS: The same assembly lines which once rolled sleek Lincoln motor car bodies out to the public are now engaged in the mass production of Ford-built jeeps. Steel frames and stampings used in these bodies come almost entirely from within the Ford plant—from rolling mill to finished product.

Speed is the essence of production for Victory and speed is "Yankee" Tools' middle name . . . speed and precision and a tremendous capacity for getting things done and done right.

Behind these pre-tested fine mechanics' tools is a half century of know-how. It has made "Yankee" Tools the preferred tools in all fields. It accounts for the fact that even our all-out effort does not fill every demand during wartime.

Be sure to provide priority ratings whenever possible. Order from your supply house or write North Bros. Mfg. Co., Dept. IA-10, Phila., Pa. Every effort will be made to meet your requirements.

★ ★ ★ ★

"YANKEE" TOOLS

make *good* mechanics *better*

NORTH BROS. MFG. CO.

Established 1880 • Philadelphia, Pa.

Structural Bookings Drop To 73,541 Tons in August

• • • **New business** booked by the structural steel fabricating industry during August amounted to 73,541 tons, according to the American Institute of Steel Construction. This compares favorably with the amount booked during December, 1918, at which time war restrictions also began to be imposed upon the construction industry, but is a sharp drop from the 113,508 tons booked in July, and the 158,658 tons booked in August of last year.

During the first eight months of the current year the industry shipped 1,425,518 tons of fabricated structural steel. The industry has on hand a backlog, scheduled for fabrication within the next four months, of 783,561 tons, which together with the tonnage already shipped provide the industry with a volume which compares with prosperous years.

Steel At Sea

Tax, Contract Confusion Make Financial Report Only A Forecast, Olds of Big Steel Says

Chicago

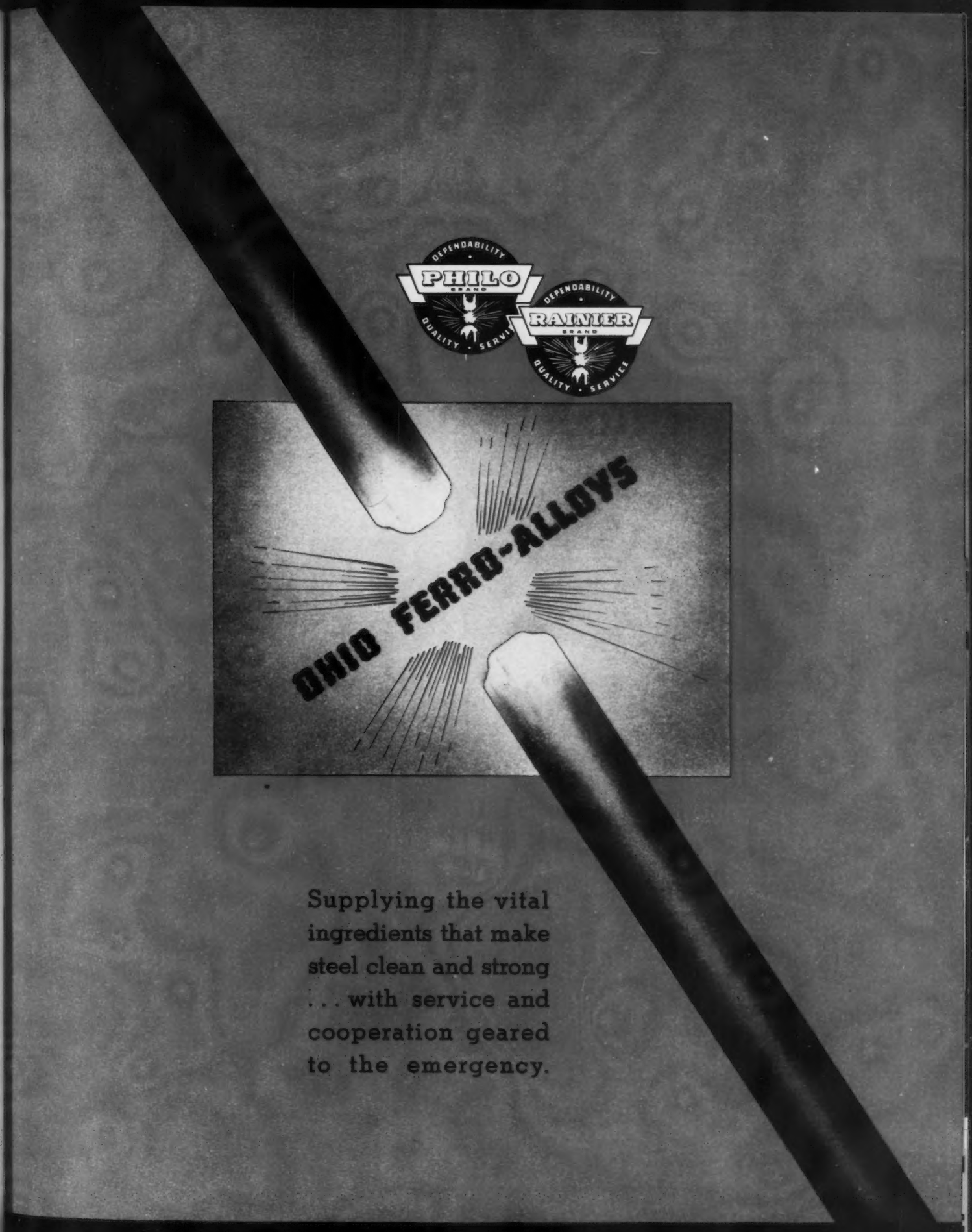
• • • **A picture of the largest steel company in the world doing the largest business in its history without knowing what the selling price of its products is, was drawn last week by Irving S. Olds, chairman of the board of the U. S. Steel Corp. This anomaly was traced by Mr. Olds to uncertainty surrounding the renegotiation clause in war contracts. The corporation's financial picture is further confused, he pointed out, by the lack of a definite tax bill. As the situation stands now, Mr. Olds said, any financial statement which the corporation may issue is largely a forecast, rather than a statement of an actual financial position.

Mr. Olds said he felt that much of this confusion would be lifted if a definite tax bill would be passed and if a definite yardstick could be established so that a company with war contracts could understand where they stood.

Mr. Olds' comments were made at a press conference here, following a meeting of the board of directors, the first meeting in the corporation's history to be held outside New York. The Chicago meeting, it was explained, was in recognition of the importance of the district's war work and was also intended to give the directors an opportunity to inspect the company's new facilities here. Holding the meeting in Chicago does not mean the establishment of a precedent, Mr. Olds said. No definite plans have been set up for future meetings.

All the corporation's directors attended the meeting except J. P. Mogan, Myron Taylor, who is in Rome, James A. Farrel and Nathan L. Miller. Participating with Mr. Olds in the press conference was Benjamin F. Fairless, U. S. Steel president.

The entire question of steel prices and dividends is bound up



Supplying the vital ingredients that make steel clean and strong . . . with service and cooperation geared to the emergency.

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in the new tax bill, Mr. Olds explained, and until a definite tax policy is set up, it will not be possible to determine exactly where the corporation stands. However, he added, the squeeze between higher taxes and high labor costs is going to find some steel companies in a "tight squeeze".

Mr. Olds said he felt that stockholders should have some return on their investment, but he also realized that what was a fair return in peace time was not necessarily a fair return in war time.

The Chicago district, it was pointed out, contains about 10,000,000 tons of ingot capacity, or about one-third of the corporation's total. This Chicago capacity compares with about 8,000,000 tons for all of Japan.

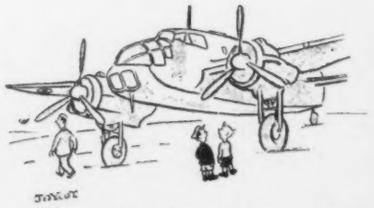
The Chicago facilities have been operating at over 100 per cent for 24 months, Mr. Olds said. For the corporation as a whole, the rate for last week was put at 98 per cent and for the preceding week at 97 per cent.

Speaking only for the corporation, and stressing emphatically that his views did not hold for the industry as a whole, Mr. Fairless said that the scrap picture was more encouraging in recent weeks. He expected the new War Materials, Inc., to be able to move large tonnages which would go far in meeting the scrap deficit. One of the reasons for the better scrap picture of the corporation's Chicago mills, as compared to other districts, was said to be the large amount of home produced scrap available and the availability of bessemer metal.

A further easing of the raw material picture is expected when new blast furnaces now under construction are completed, he said. The entire question of steel making operations, Mr. Fairless explained, was one of metallics. It did not make a big difference whether the metallics came from pig iron, scrap or sponge iron, although for technical reasons, pig iron was preferred.

So far as U. S. Steel is concerned, there are no plans for building sponge iron plants, Mr. Fairless stated. This again, he elaborated, was a reflection of the corporation's own particular position. He said that sponge iron can be made, but so far as the corporation was concerned, it could not be made as economically as could other types of metallics. They would prefer to build blast furnaces to make up any deficiency in metallics.

Steel making capacity in the Chicago area is expected to be raised some 500,000 tons when projects now under way are completed, it was said. The gigantic Homestead development is expected to be in partial operation by the end of this year and in full operation by June of next year. The status of the various Chicago projects now under way is listed elsewhere in this issue.



. . "I wonder where the elastic is?"

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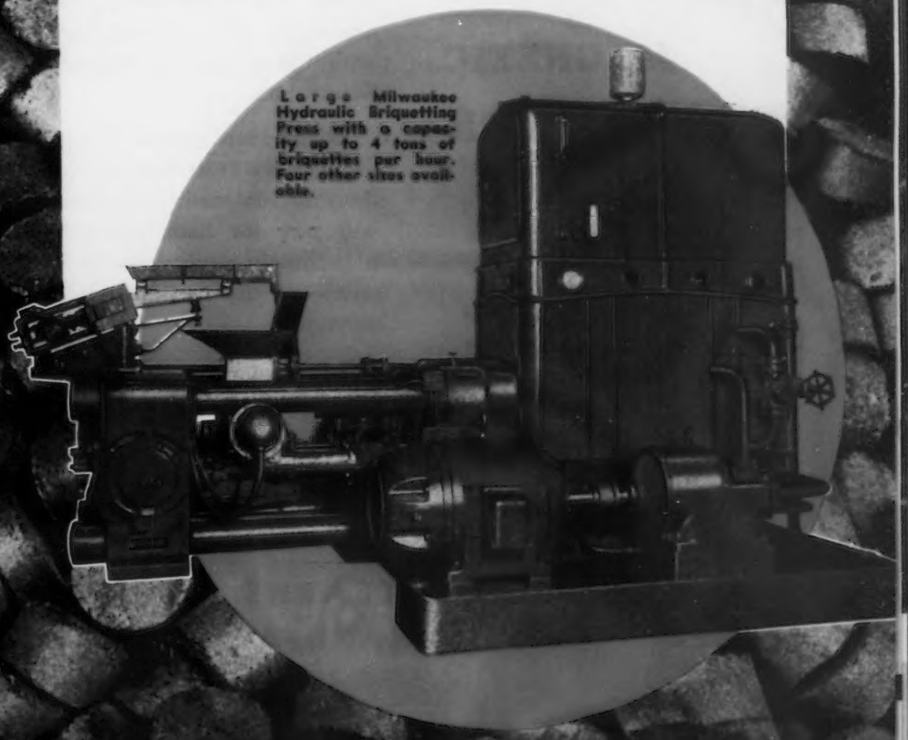


Large Milwaukee Hydraulic Briquetting Press with a capacity up to 4 tons of briquettes per hour. Four other sizes available.

Help Win the War by BRIQUETTING Metal Scrap

Stranded Steel Products Now Covered by MPR-209

Washington

• • • **After Oct. 1,** sales of distress or stranded iron and steel products destined for export became subject to Maximum Price Regulation No. 204. This regulation covers idle or frozen materials sold under Priorities Regulation No. 13. These sales were made subject to Maximum Price Regulation No. 13 as the result of OPA's announcement that Oct. 1 was the expiration date of special provisions in Revised Price Schedule No. 49, covering resale of iron and steel products which govern the sale of distress or stranded steel products for shipment abroad.

These products include those which had been shipped to a port prior to March 1, 1942, thus incurring charges for ocean freight, marine or war risk insurance, or storage where ocean shipping space could not be obtained. In this category also were certain shipments which were on the high seas when America entered the war and which were ordered back to American ports.

Banks, trust companies, representatives of foreign governments and companies, and exporters liquidating idle or frozen iron and steel products in the domestic market after Oct. 1 are to price their sales under Maximum Price Regulation No. 204, OPA pointed out. Steel brokers and all others customarily engaged in reselling iron and steel products domestically, however, must after Oct. 1 dispose of idle or frozen items under the pricing provisions of Revised Price Schedule No. 49.

Under the special provisions of Revised Price Schedule No. 49, which expire Oct. 1, maximum prices for idle or frozen iron and steel products destined for export included storage or demurrage charges, ocean freight, and marine and war risk insurance actually paid. The special provisions also permitted the seller to use the domestic ceiling price at location of the material. He could then price f.o.b. location.

Under Maximum Price Regulation No. 204 the seller of idle or frozen materials is not permitted to include in his maximum price any of the foregoing special charges but he is allowed to use the domestic ceiling price at the location of the material computed on the basis of the quantity originally purchased from his original supplier, and then price f.o.b. location. OPA also advised that all export sales of iron and steel products including those idle or frozen continue to be governed by the Revised Maximum Export Regulation.

•

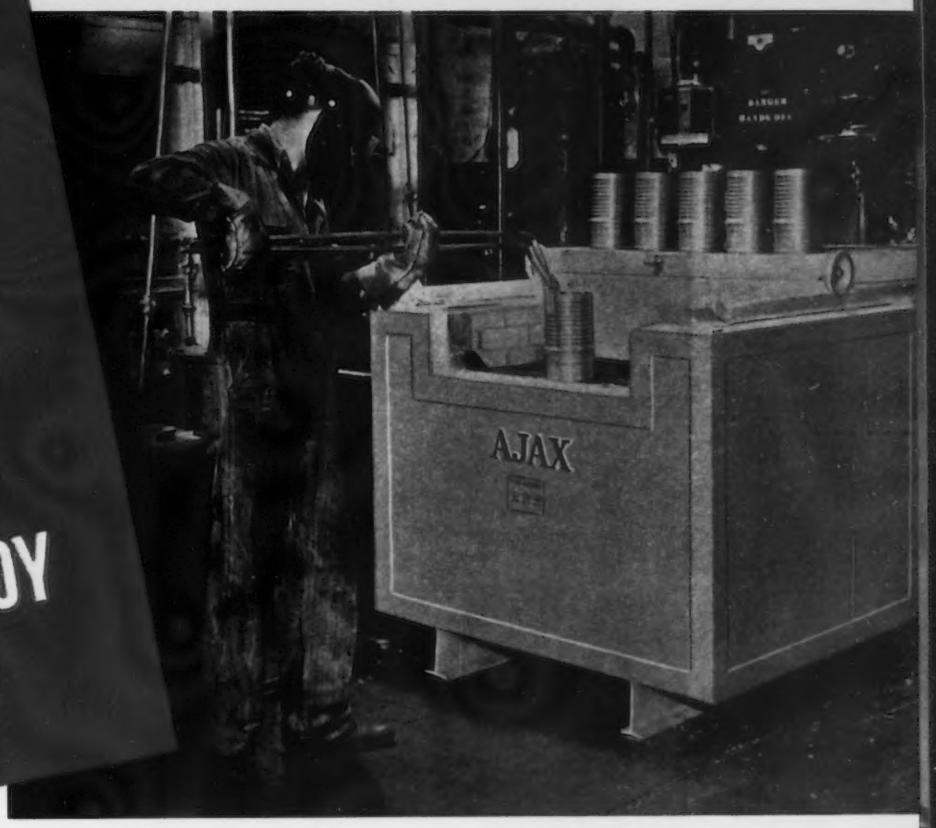
New Price On Tungsten Powder

• • • **Cleveland Tungsten, Inc.,** of Cleveland, Ohio, was granted permission by the Office of Price Administration to charge $5.40 a

Why Salt Baths are THE LOGICAL WAY TO HARDEN

WITHOUT DECARB OR SCALE ✓
WITH MINIMUM DISTORTION ✓
AT FASTEST HEATING RATE ✓

CARBON AND ALLOY STEEL PARTS



Immersed in the salt bath at 1550 deg. F. and quenched over a mandril in oil, big cylinder sleeves shown hold diameters to .007" at output speeds of 120 in 8 hours, using the 65 kilowatt Ajax-Hultgren furnace illustrated above.

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2. A salt bath is the fastest heating medium for transferring heat to work. Therefore, an Ajax furnace will yield more completed heating cycles per day than any radiation or forced convection system.

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4. All forms of hardening in an Ajax-Hultgren furnace may be done selectively, as desired. This feature itself is only a partial demonstration of the great flexibility of these units as used in industry today.

It is only logical to find that there are now more than a thousand Ajax-Hultgren Electric Salt Bath Furnaces in use* for... hardening armor plate, armor piercing shot, dies... aircraft structures, steering gear assemblies, ordnance components, gears, high speed steel tools (up to 2400 deg. F.), etc.

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pound, f.o.b. seller's plant, for tungsten metal powder containing a minimum of 99.7 per cent tungsten and a maximum of 0.2 per cent alkali and 0.02 per cent molybdenum.

This is a purer grade of tungsten metal powder than was formerly produced by the company in March, and requires a special price. The new price was authorized in Order No. 77 under section 3 (b) of the General Maximum Price Regulation, and becomes effective September 28.

•

Reusable Pipe Prices Set

• • • **Dollars-and-cents** maximum prices for reusable iron and steel pipe, cutting ceiling quotations back to levels of Oct. 1-15, 1941, were established Sept. 28 by OPA.

The prices, contained in Maximum Price Regulation No. 230 (Reusable Iron and Steel Pipe), apply to sales to consumers and become effective Oct. 3, 1942. Previously, reusable pipe was covered by Revised Price Schedule No. 49.

The dollars-and-cents ceiling prices contained in Maximum Price Regulation No. 230 are on a shipping-point basis. Prices fixed for reusable pipe other than oil country tubular goods in terms of percentage of jobbers' resale prices on new pipe are 70 per cent of the list price of the lowest grade of new pipe having the same diameter and weight per foot.

Prices fixed for reusable oil country tubular goods are 75 per cent of the list price of the lowest grade of new oil country tubular goods having the same diameter and weight per foot.

"Reusable iron and steel pipe" as defined in the regulation means used iron and steel pipe suitable, without further reconditioning, for use by the consumer for the purpose for which the consumer purchased it, suitable for use for any purpose for which new pipe of prime quality customarily is used, and, in addition, capable of conducting without leakage liquids and gases at a pressure of at least 50 pounds per square inch.

Reusable oil country tubular goods are defined as reusable oil well casing, tubing, drive pipe and drill pipe suitable, without further reconditioning, for use for a purpose for which such pipe of prime quality customarily is used.

•

Wheeling Assisted

• • • **Wheeling Steel Corp.** was granted permission by OPA to charge higher base prices for small billets and sheet bar produced for the Lend-Lease Administration at its Portsmouth, Ohio, plant.

At the same time a request by the company for higher base prices for ingots and blooming mill billets and slabs was denied.

Effective Sept. 28, the company may charge a base price of $36 per gross ton for small billets, f.o.b. Portsmouth, compared with $34 previously. A price of $39.08 per gross ton had been asked by the company in a petition to OPA.

Effective Sept. 28 also, the company may charge $37 per gross ton for sheet bar, f.o.b. Portsmouth, compared with $34 previously.

Although other requests were denied the company was allowed to charge the maximum basing point base prices f.o.b. Portsmouth.

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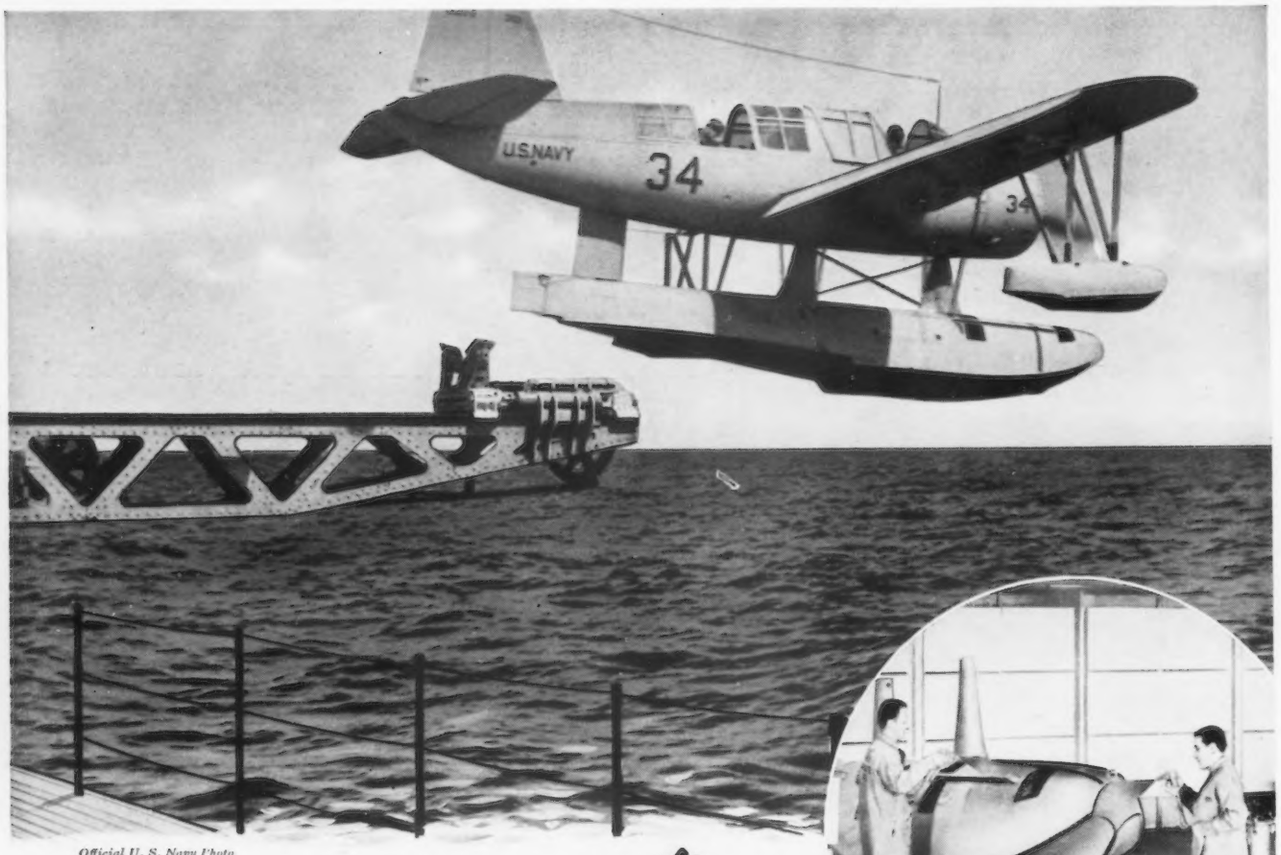

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● In these days of lightning air attacks from great distances, the range of a lookout's spy glass in the crow's nest is not enough. So, our Navy has developed the *flying crow's nest*—a scouting plane with pontoon "water wings"— that can be catapulted from the deck of a warship and landed on the sea.

DeVilbiss Spray Equipment is helping to rush more and more of these far-seeing lookouts into service. It makes possible the high-speed finishing of these unique planes with durable, waterproof coatings so necessary for their protection in salty, sea-going service.

Here is just another example of how DeVilbiss Spray Equipment is today speeding the production of all sorts of war weapons—from shell fuses to big guns, from bombs to bombers, from jeeps to tanks, from marine engines to battleships.

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DEVILBISS
SPRAY SYSTEMS

New Plan For Processing PD-25-a Applications Set

Washington

• • • **Just as though** WPB were starting out to distribute materials for the first time, the war agency has planned a completely new organizational setup to handle the fourth quarter material control program. The program provides that the Priorities Division will assume the responsibility of developing general procedures and establishing standards for the processing of all PD-25A applications. New rules for PD-25A routing, Requirements Committee and ANMB functions and duties, the setting up of material accounting methods within the WPB branches, and the control of PD-25A's within the branches have been established.

However, WPB did make some mention of its plans to rejuvenate PRP late in August, but the full story of the changes to be wrought has not been made public by WPB. Officials say that the reason for not disclosing full details is that some of the changes, such as material accounting, have been needed and promised for a long time. And since WPB has been delinquent in making them, it is embarrassed to admit that elementary procedures have been so long in being adopted, it is said.

In general, the plan provides for a system of authorizations to industry to purchase specific quantities of materials premised primarily on the information forthcoming from PD-25A applications, followed up by interim allocations which will control the preliminary distribution of material in the manner which is most consistent with the requirements of the production program.

The PD-25A processing directions now in use are being reviewed for the purpose of making them as comprehensive and uniform as reasonably possible.

The Product Assignment Section will have full authority to route cases in accordance with major responsibility based on product classification. The WPB branches will handle all PRP units which produce civilian or mixed military and civilian products. The ANMB will establish a processing section to handle applications which are 100 per cent military. Those PRP units which produce such a diversification of products that no one branch can be made responsible will be assigned to the PRB Branch of the Priorities Division. All disputes between branches as to jurisdiction over cases will be decided by the Deputy Director General for Operations or his designated assistant. The applicant will be notified at the time his application is received as to which branch of the WPB or ANMB is responsible for the processing of the application and it

will be directed that all correspondence concerning the application shall be addressed directly to the branch which is doing the processing.

The Deputy Director General for Operations will organize within each branch a competent staff of analysts to handle the processing of PD-25A applications. This staff will be chosen for its knowledge of the industries to be handled in the branch and of priorities procedure. The Priorities Division will assign a competent priorities representative to counsel with the branch staff on policy and procedural matters.

The original of each application, complete with all accompanying letters, will be transmitted promptly to the appropriate industry branch or the ANMB. Another copy of these documents will be transmitted to the Bureau of the Census for tabulation pursuant to the agreement formulated by the PRP Operating Committee. The census will tabulate reported material requirements by 223 end products. The census will also tabulate material requirements by 223 end products, and requirements on a classification corresponding to the branch distribution of applications. A standard tabulation form will be developed to be used for each branch upon which materials will be classified by principal products with the rating pattern designated for each end product. The total material requirements for all PD-25A applications received up until the cutoff date, will be submitted to the Priorities Division for review and submission to the Requirements Committee. Each branch will also make preliminary estimates of the material requirements for end products under the jurisdiction of the branch but not reported in any PD-25A application.

These estimates will be submitted to the Requirements Committee by the Priorities Division along with the requirements tabulated under the PD-25A applications. The branches will begin immediately a preliminary investigation of applications starting with the most important cases. Should this preliminary investigation be far enough along to afford a basis for preliminary branch estimates of material requirements, the branch will submit each preliminary estimate to the Priorities Division for the guidance of the Requirements Committee.

A uniform system for controlling PD-25A applications within the branches will be established. This system will provide (1) a record and follow-up mechanism for all cases in the branch in process or pending, including a definite means of locating cases which are in the hands of processors, (2) date for gaging the time used in processing, and (3) a measure of the work load on the branch.

The Requirements Committe will review the materials requirements as summarized by each branch, the preliminary branch estimates of essential material requirements and the census figures on materials


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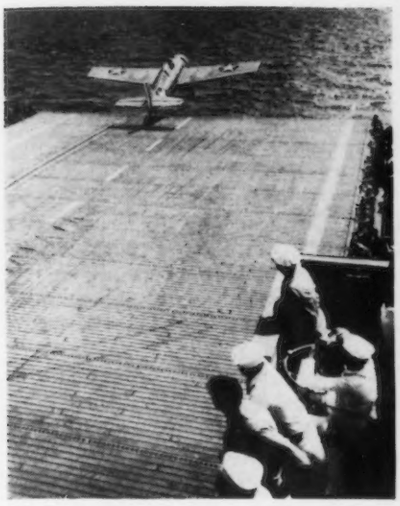
requirements classified by the 223 end products. From a consideration of these data and the general military and civilian programs, the Requirements Committee will make an allotment to each branch of the materials which can be made available for meeting the requirements of PD-25A applicants for the quarter.

In addition to the allotments of material for PD-25A applicants, the Requirements Committee will allot to each branch a separate bank of material to be distributed to small producers not embraced in the PD-25A class. It is contemplated that the Requirements Committee may reserve some materials for later general programs not included in the data submitted from the branches. Certain complex items, such as chemicals, will not be distributed by the Requirements Committee, but will be handled by the priority rating system or by specific directives from the Chemicals Branch subject to policy instructions from the Priorities Division.

The determinations of the Requirements Committee will be transmitted to the branches through the Priorities Division, together with such supplemental policy instructions as may be necessary to effectuate the general distribution of materials to branches as established by the Requirements Committee. Processing directives will assure the execution of the Requirements Committee determinations and permit uniform and consistent processing throughout the branches.

The materials allotted to the branches and to the ANMB branches by the Requirements Committee will be distributed to the representative PD-25A applicants pursuant to the established processing rules and policy instructions. Consistent with such instructions, the branch will have the responsibility for distributing the available material to the PRP units over which it has jurisdiction, giving proper consideration to the importance of the requirements of each unit in the overall program. To accomplish this result, the branch analysts must have an adequate knowledge of the production of each applicant. Employees of the Army and Navy and WPB already located in these plants may be called upon for information and guidance in the



Acme Photo

WINGS ON THE DEEP: It's a breath-taking moment when one of these stubby winged little fighters takes-off from the flight deck of a carrier. Shown here is a plane just taking to the air from the deck of the new naval aircraft carrier U.S.S. Charger which was converted from a merchant vessel.

processing of the applications. The PD-25A's as so adjusted will be returned to the Priorities Division for final review and issuance.

The Army and Navy Munitions Board representatives will review the processing in the branches and in the special PRP Branch. This review should be final so that no overall review by the ANMB should be necessary in the Priorities Division.

The branch will establish, pursuant to instructions of the Priorities Division, a budgeting and accounting procedure for the materials allotted to the branch as distributed to PD-25A applicants. This system must show a quarter-by-quarter account of the initial allotments, interim changes, actual use, reported requirements and inventory levels.

The material branches will be consulted in the preliminary distribution of PRP units wherever they have information which may be helpful in processing the applications. The material branches will be advised of the preliminary distribution to specific PRP units and will assume responsibility at the request of the representative end-products branches for assisting manufacturers in getting orders placed and filled as included in the preliminary processing.

The PD-25A method will serve

only as a rough preliminary distribution of critical materials to producers. It is appreciated that many interim adjustments will be necessary and that these adjustments will require the filing of interim applications and other information. Where producers have reason to believe that they will need less than the authorized amounts, they will be required to promptly notify the branch which is responsible for processing their representative applications so that the materials can be certified to other producers needing additional allowances. Producers which need additional materials will file an interim request which must be handled speedily and if warranted, additional materials will be allotted from a contingency reserve to be maintained for this purpose.

The Priorities Division will watch the status of the contingency reserve and, if necessary, recommend to the Requirements Committee interim adjustments between branches or between programs. The interim adjustments necessary will be worked out with the various branches to insure the filling of orders as a result of interim adjustments.

Interim inventory reports will be devised so that each branch may maintain contacts with the flow of materials through the inventories of the PRP applicants for which the branch is responsible and the field staff will be requested to make investigations from time to time where the inventory controls indicate an unbalanced condition or the receipt of materials in excess of current needs.

•

Steel Directors Working Effectively, Batcheller Says

• • • **The system of issuing** Steel Production Directives, inaugurated by the WPB Iron and Steel Branch about two months ago, is proving very successful in directing the production of the most urgently needed steel products and strengthening controls over output, Hiland G. Batcheller, chief of the branch, reports.

A committee of the branch, known as the Production Directive Committee, meets with representatives of each steel producer to plan monthly output by products. The committee investigates all pertinent facts, such as the com-

pany's producing facilities, unfilled orders, relative priority ratings, etc., and then formulates a production directive indicating the product distribution for the company on a monthly basis.

This directive reflects the basic determinations of the WPB Requirements Committee. For instance, if the Requirements Committee has determined that 1,100,000 net tons of plates should be made in a particular month (this is the present figure) the total of all directives issued will equal this figure. The part of the total tonnage to be made by each producer is determined by the Production Directive Committee.

Within the limits of each production directive, companies must schedule their orders on a priority basis. That is, if a company is directed to produce 5000 tons of bars per month, it then schedules the 5000 tons of bar orders on its books which have the highest priority ratings, and which are to be delivered in the specified month.

In respect to non-integrated steel companies (those who purchase steel for further conversion) the Production Directives are issued on a slightly different basis. The committee schedules the rate of operations of the producer on a basis comparable to integrated steel companies manufacturing the same product. The Directive is then supported by an allocation of the necessary steel from specified integrated companies to the non-integrated producer. In this manner, the non-integrated producer can plan his operations on the same basis as the integrated producer.

The committee has issued 84 Production Directives, 46 to integrated producers and 38 to non-integrated producers. Practically all of the integrated producers have been covered but a large number of the non-integrated companies are yet to be directed. Full coverage of the industry in 30 to 60 days is expected.

Mr. Batcheller said that the Production Directives are increasing output because of their stabilizing effect. They are also creating steadier employment for labor and providing the means of making changes in the steel product distribution in the best interests of the war effort.

The directives are signed by the Director General for Operations of

the War Production Board. They remain in effect until changed and are constantly reviewed, and if necessary, revised by the branch.

•

New Ideas in Quota Plan

• • • **Ideas on** steel distribution control brought back to the United States by the recent steel mission to Great Britain may be incorporated into the quota system for production and distribution control now under study by WPB and other government agencies, some persons believed early this week.

The steel plan originally submitted by Reese Taylor and covered in THE IRON AGE, Sept. 24, p. 82, was reported to stand a good chance of being put into operation as soon as the various government agencies can set up specific personnel to handle their part of the plan. Some sources believed that first quarter steel production distribution will be under the control of a steel director and working under a plan to spell the end of the hit and miss or trial and error period of approach to the general overall steel problem.

When and if the steel quota plan begins to work, it is some persons' belief as stated in THE IRON AGE last week that PRP is doomed, with perhaps the entire priority system also slated for the ashcan.

Following a meeting last week in Washington attended by WPB officials, steel advisers, and governmental agency men, some changes were proposed for the original Taylor plan to make it somewhat similar to the present British steel control vehicle.

The provision for the establishment of "C," "D," and "X" symbols as described previously was reported eliminated. Incoming orders will be set up on the basis of bona fide requirements from the various governmental agencies after approval of the steel requirements board. Steel companies will not have to accept new orders which total more than 110 per cent of their production quota for a given product in a given month. This in reality means approximately 105 per cent of their estimated rolling schedules since steel quotas for various products are being set up on the basis of 95 per cent of the submitted schedule.

If a steel company is "filled up" and turns down an order, a proper report is to be made to the WPB. Probably more far reaching and representing the simplest approach to the question yet is the interpretation that under the new plan, mandatory plate schedules and melting schedules will be eliminated since complete distribution of all steel products will be under tight control.

Obviously if the plan goes through many sudden changes might have to be made in various steel requirements and production due to unforeseen events. Hence when a steel order is placed under the new system, a steel company will not be obligated to promise delivery in a specific week but may commit itself only for a given month. The government agencies placing orders some several months in advance will only be allowed to enter certain proportions of their actual first quarter, 1943, requirements.

Considerable work may be nec-

essary before the actual functioning of the plan will begin, but from here on out it is expected the groundwork will be rapidly laid since the plan, in the opinion of all those involved, represents the most common sense approach yet presented.

•

Casket Steel Again Curtailed

• • • **Use of iron and steel** in caskets, shipping cases and burial vaults is further curtailed by an amendment to General Limitation Order L-64, issued by the Director General for Operations. For a period of 90 days (Sept. 24 to Dec. 23) the amount of iron and steel that may be used in joining hardware may not exceed 6 lb. per casket. If the casket contains any handle hardware assemblies which were completely fabricated prior to March 28, 1942, the amount of iron or steel may not exceed four pounds per casket. Beginning Dec. 23, the weight of joining hardware may not exceed four pounds per casket, whether or not the casket contains handle hardware assemblies. Effective immediately, the use of iron and steel in handle hardware for caskets is prohibited.

•

Order L-114 Interpreted

Washington

• • • **An interpretation** of Order L-114, which governs the use of critical materials in the manufacture of various types of safety equipment, was issued last Friday by the WPB Director General for Operations to clarify the kinds of measuring and indicating instruments which are subject to its terms.

Order L-114, the interpretation stated, covers only the types of measuring and indicating instruments used to promote safety or to prevent or reduce accidents, injuries, occupational hazards or diseases.

Measuring and indicating instruments used in industrial processes, such as control valves, temperature bulbs and thermocouples, are covered by Order L-134, which restricts the use of chromium, nickel and their alloys.

•

Steel Producers Freed To Assist Emergency Needs

Washington

• • • **Pointing out** the necessity of maintaining full capacity steel operations, WPB Director General for Operations Ernest Kanzler last week gave producers telegraphic permission on a trial basis to accept deliveries of maintenance, repair and operating supplies in excess of PRP authorizations when necessary for essential operations. Uncontrollable factors, it was explained, make it difficult to estimate in advance operating and maintenance needs for this country.

Notwithstanding provisions of paragraph (D) (1) of Priorities Regulation 11, the telegram said, "each producer of iron and steel products as defined in Schedule A of Order P-68 for the fourth quarter of 1942 (1) shall not be required to maintain budgetary control of individual items used for maintenance, repair, and operating supplies for the purpose of checking current receipts against authorizations granted in its PRP certificate; (2) may accept deliveries of such materials in excess of the quantity specifically rated or other-

wise authorized on its PRP certificate and (3) may apply the ratings assigned by its PRP certificate to deliveries of such materials to the extent such deliveries are essential for proper operation subject to the restrictions of Priorities Regulation 1."

•

Ratings on Cargo Space

Washington

• • • **The existing** permit system of the Office of Defense Transportation, applying to certain types of Great Lakes vessels, will be extended shortly to control the movement of virtually all commercial craft, Joseph B. Eastman, ODT Director, said last Friday. An ODT general order, to be issued soon, will require that no person shall operate any vessel on the Great Lakes except in such manner as may be authorized by general or special ODT permit.

Extension of the permit system will allow ODT to put into effect a new schedule of domestic shipping priorities recently transmitted as a directive to ODT by WPB. The revised priority schedule, made effective Sept. 11 by WPB Certificate of Necessity for Priority Action No. 2, was formulated to assure ample cargo space for the preferential movement of tremendous quantities of iron ore on the Great Lakes, as well as to assure the movement of other commodities essential to the war effort. Among other commodities are pig iron, and ferro-manganese.

The certificate directs the ODT to execute transportation priorities which give to iron ore moving in ODT-certified ore carriers an A-1 rating; to coal, coke and other commodities transported in certain types of vessels, an A-2 rating, and to other items various lower ratings. It requires conformity to the WPB priority ratings for bulk commodity movement.

Revision of the priorities schedule and extension of the ODT permit system was made necessary by increases in estimates of the volume of iron ore which must be shipped from Lake Superior mines to other Great Lakes ports and thence to the steel companies. In defining preferential classes of commodities, the revised priorities schedule recognizes that "the application of all ratings is subject to the practical exigencies of loading and scheduling operations which are matters entirely for ODT's consideration."

•

Copper Scrap for Foundries On A-1-a or Higher Ratings

Washington

• • • **Beginning Oct. 1,** copper scrap, copper-base alloy scrap and ingot will be available to foundries only when their orders bear ratings of A-1-a or higher. Primary copper has been available for only A-1-a and higher orders for several months. The order puts scrap and ingot in the same position as primary copper. Only special authorization by the WPB Director General for Operations will now enable the metal to be shipped on ratings lower than A-1-a.

Foundries' applications for requirements on Form PD-59 are required to be filed with WPB on or

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You should know these blades because they have so many advantages over the ordinary type of cut-off blades. (1) Their distinctive T-shape provides exceptional side clearance, (2) the hollow-ground top allows free escape of the chip, and (3) the continuous longitudinal taper maintains a constant back clearance regardless of repeated sharpenings. Thus, excessive friction, which is the greatest cause of breakdowns, is eliminated.

Blades, both tapered and parallel in the longitudinal cutting width, carried in stock.

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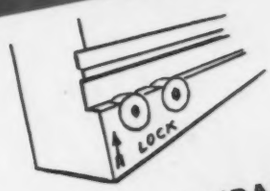

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You should know these tool holders for their unusual features in facilitating and speeding cutting-off operations. Aside from accommodating the Luers Blades, they possess these unique advantages: (1) will hold blade with bull-dog grip by virtue of the specially-designed, double-cam lock, (2) provide speedy and simple set-up of blade, (3) permit quick removal of blade alone for resharpening, without disturbing set-up, (4) admit quick replacement of blade accurately to original position, (5) made for all standard hand and automatic screw machines.

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PRODUCED UNDER LICENSE ISSUED BY JOHN MILTON LUERS PATENTS, INC.

The Blades That Reduce Friction

EMPIRE Tool Co.

8788 Grinnell Ave.
Detroit, Mich.

before the 5th of the month preceding the month in which delivery is sought.

•

Tar Coatings Prohibited

Washington

• • • **Savings of** tar and conservation of transportation facilities, together with reduction of inventories, are expected by WPB to result from its order last Thursday prohibiting the use of tar coatings on cast iron soil pipe. The action was taken in an amendment to Schedule 4, as amended, to Order L-42. WPB said that last year approximately 65 per cent of all cast iron soil pipe was coated with tar and that consumption for this purpose was about 640,000 gal.

•

PD-637 Not for General Use

Washington

• • • **The Form PD-637** production directives which WPB regional directors were authorized to issue on Aug. 26 by J. A. Krug, Chief of the WPB Bureau of Priorities, take precedence over AAA ratings, but the use of the form is confined to one group of strategic products. When the demand for this group of strategic products ceases, WPB plans to scrap the use of PD-637. It is not intended for general application.

•

Lawson Quits Federal Aircraft

Ottawa, Canada

• • • **Department of Munitions** and Supply announced that Ray Lawson has resigned as president of Federal Aircraft Ltd., a government owned company, and is succeeded by W. A. Newman, managing director of the company since 1941. Formed to administer production of advanced twin-engined Avro Anson trainers for use by the Royal Canadian Air Force in Canada, Federal Aircraft Ltd. recently delivered its 1000th Anson.

•

Canada Restricts Copper

Ottawa, Canada

• • • **Department of Munitions** and Supply announced that the use of copper in Canada for the manufacture of steel plates or sheets is now prohibited except by permit in

writing from G. C. Bateman, Metals Controller.

•

Frozen Stock Rules Revised

• • • **Priorities Regulation No. 13,** issued last July to provide uniform rules to govern sales to war industries of frozen stocks of restricted materials, has been amended to exclude any material rationed at retail levels, to include intra-company transfers of material in specified circumstances, and to clear up certain ambiguities which have come to light during the course of operations in the field.

Specifically included within the scope of the regulation by the amendment are sales made in the course of the liquidation of a going business or the assets of such a business.

Intra-company transfers are allowed under the same conditions as are sales of the given material. Schedule A to Regulation 13 also is amended to include a number of items placed under priorities control since its issuance, and to alter the conditions under which frozen or otherwise idle stocks of certain materials may be disposed of.

The most important change in Schedule A permits sale for authorized uses, on ratings of AA-2X, of single lots of carbon steel of more than five short tons. Single lots are defined in the amended regulation as "all material of the same size and specifications at the same location." This change is expected to expedite the movement from immobilized stocks of this essential war metal. Previously, sale of lots of more than five tons might only be made to producers of the material in the same form in which it had been purchased by the holders.

•

Chicago Plant Construction Tripled in September

Chicago

• • • **Large dollar volume** of plant construction in this area continued over the past month, the amount being almost triple that of September of last year, according to the Chicago Association of Commerce. Investment in new plants and expansions during September totaled $25,195,000 compared with $8,896,000 in the same month in 1941. The total volume of Chicago area industrial developments for 1942, to

date, now stands at $555,865,000, Mr. Lyon added.

•

Order L-148 Amended

• • • **The War Production** Board has amended order L-148, covering production and delivery of equipment for telephone and telegraph companies, to allow deliveries 90 per cent or more completed by Sept. 8. This will permit completion of projects for which only final construction details remained to be taken care of when L-148 was issued. The action will eliminate necessity of appeals to the War Production Board for projects 90 per cent or better completed. It is estimated that there would be 1700 such appeals if today's amendment were not issued.

•

Cryolite Under Control

• • • **Cryolite** was put under complete allocation and use control, by General Preference Order M-198, issued Sept. 18. Cryolite, both natural and synthetic, may not be delivered, received, or used after Oct. 1 except by specific authorization of WPB. The sole exception of this provision is the receipt and use of it as an insecticide. Natural cryolite comes from Greenland. It is essential in the manufacture of aluminum and in ceramics, and a small amount is essential in abrasive manufacture.

Requests for authorization to receive or use cryolite are to be made to WPB on Form PD-592. Requests for authorization by producers to deliver cryolite to be used as an insecticide are to be made to WPB by letter. Initial requests to use or receive cryolite are to be accompanied by inventory and consumption Form PD-632.

•

Hairpin Supply Cut

Washington

• • • **Women** of the nation have been called upon to make an added sacrifice for the war effort. Their supply of bobpins and hairpins has been cut further. They'll have to get along with one bobpin or hairpin in 1943 for every four they had in 1941. WPB came out with this edict last Saturday and estimates that compared with 1941, approximately 5700 tons of steel will be saved as the result of the curtailment, effective immediately.

Another Guide to Priorities Ready Soon

• • • A new Priorities Guide being prepared by THE IRON AGE is scheduled to appear in the Oct. 8 issue. It will include new material and revisions. The last Guide was issued June 4. The new Guide will be the seventh in a series.

Since the demand always exceeds the supply, advance orders for copies of the Guide are now being taken. The price schedule follows:

1 to 10 copies .....50c. each
11 to 100 copies.....40c. each
101 to 300 copies .....35c. each
300 or more copies... ..30c. each

Stamps or coin with orders for $2 or less would lighten our load.

This action was taken through an amendment to Order L-104 which restricts manufacture of the pins to a rate equal to 25 per cent of 1941 production. The original order, issued April 25, had already cut production by 50 per cent.

•

Revision of PD-200 Coming

Washington

• • • Plans to survey the capacity of all industry and the amount of material to be consumed in the $20,000,000,000 facilities expansion program are under way at WPB. Approval of the program was given without advance knowledge of industry capacity or material requirements for construction. Both the armed services and WPB have been concerned about the rate of metal consumption in the building of munitions plants. The present program now is consuming from 16 to 20 per cent of steel ingot output. The war agencies are worried because the building program threatens to put the entire material supply out of balance.

A revision of Form PD-200 which is presently being used as an application for construction priority assistance and as an application for authority to begin construction which requires no priority assistance will be employed to get the requirement information. Form PD-200 is to have the same relation to the construction program as PD-275 had to metals.

Form PD-200 is divided into four sections, two of which are to

(CONTINUED ON PAGE 222)

Chicago Ordnance Appeals for Tools

Chicago

• • • **An urgent appeal** to manufacturers in Chicago Ordnance District to survey their plants for the purpose of uncovering critically needed idle machine tools has been issued by Brig. Gen. Thomas S. Hammond, district chief.

In a letter addressed to several hundred manufacturers within the district, Gen. Hammond stressed that important war projects in this area are being held up due to a shortage of certain types of machine tools. In view of the fact that many new tools now on order will not be delivered for several months, the Chicago Ordnance District is determined to put all idle and surplus tools into war production.

According to Henry P. Isham, chief of the planning division of the Chicago Ordnance District, the War Department has been authorized to arrange for the purchase or lease of all needed machine tools that are voluntarily submitted by manufacturing concerns. Upon receipt by the machine tool section of the Chicago district of a company's list of one or more surplus and idle tools, a government engineer will inspect the tools to ascertain their size, specifications, age and condition. Usable tools acquired by the Ordnance department will be made immediately available to manufacturers having a need for them.

"Through this new plan whereby the Ordnance department can arrange for the purchasing and leasing of tools offered by manufacturers, we hope to eliminate many production bottlenecks that now exist in the mid-west plants due to tool shortages," Mr. Isham said.

The most critical types of machine tools needed by the ordnance district are listed below. Manufacturers are also urged to report other types of equipment which may be used in war production.

Hand Screw Machine or Turret Lathe
- Horizontal Multiple Spindle
- Vertical Multiple Spindle
- Semi-automatic
- Chucking
- Hand Feed

Automatic Screw Machines
- Brown & Sharpe
- Single Spindle
- Multiple Spindle

Boring Machines
- Horizontal
- Vertical
- Jig Borer

Lathes
- Low Swing Type
- Gap
- Bench
- Production
- Tool Room

Milling Machines
- Engraving
- Router
- Profiler
- Planer Miller
- Vertical
- Universal
- Hand

Drill Press
- Single Spindle
- Multiple Spindle
- Radial

Grinding
- Gear Tooth
- Tool
- Disk
- Centerless
- Surface
- Internal
- External
- Universal
- Thread

Thread Millers, Planers
- Side (Open)
- Double Head
- Single Head

Gear Cutters
- Hobber
- Thread Mill
- Gear Shaper
- Keyseater

Broaches
- Surface
- Internal Horizontal
- Internal Vertical

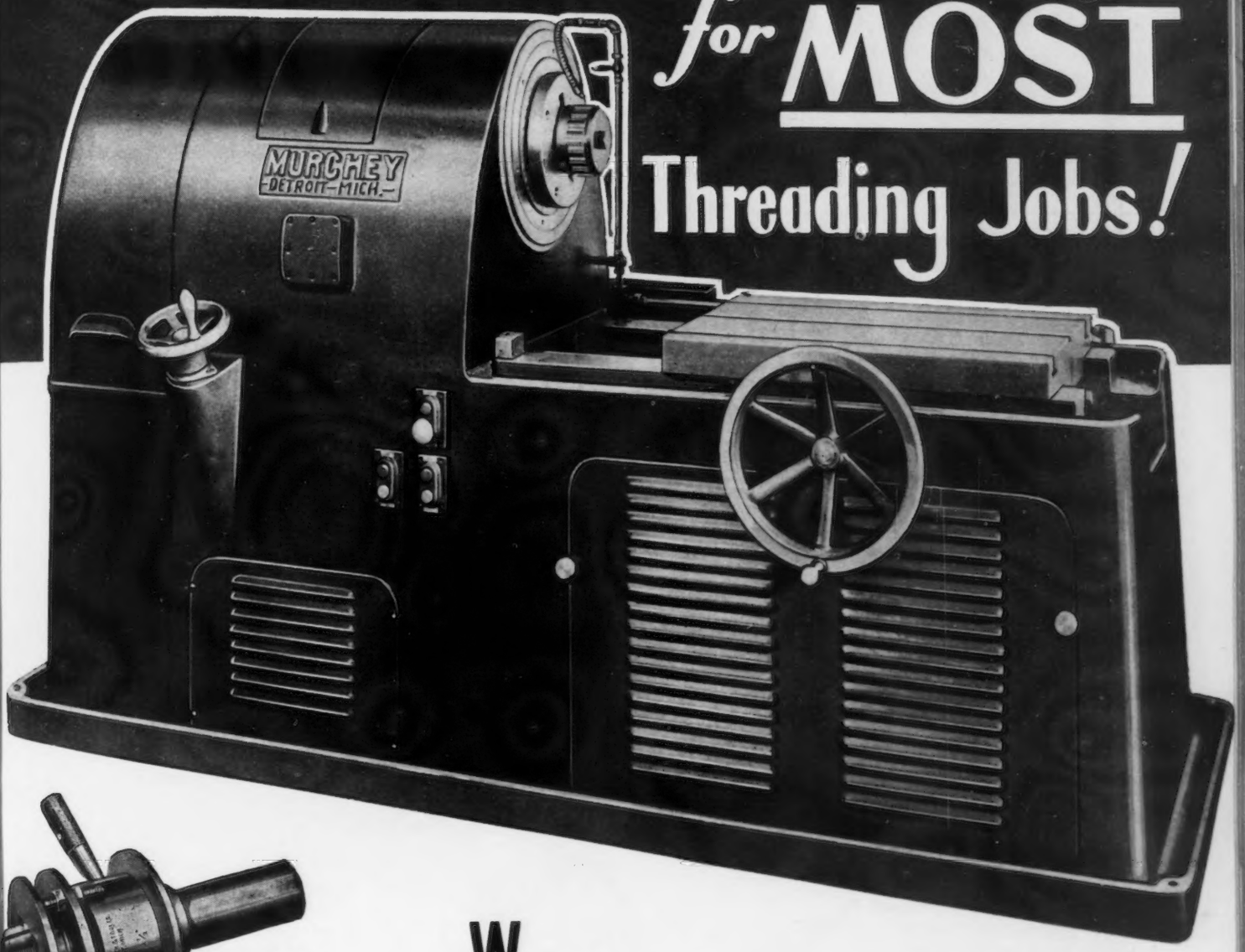
Shapers

Blough Heads WPB Contract Review Branch

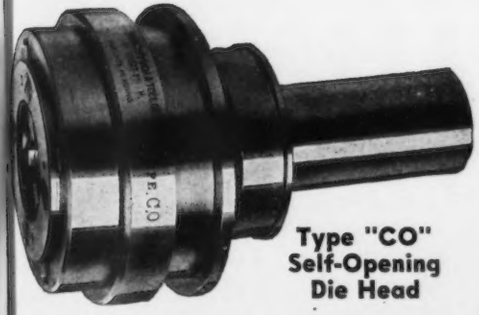
Washington

• • • **Carman G. Blough,** New York, has been appointed Chief of the Contract Review Branch of the WPB Procurement Policy Committee. He succeeds Dr. Thomas H. Sanders, acting branch chief and chief of the Cost Analysis Section. As chief of the Contract Review Branch, Mr. Blough will serve as WPB representative on the Price Adjustment Boards of the War and Navy Departments and the Maritime Commission.

There's A Murchey for MOST Threading Jobs!



Type "M" Collapsible Tap



Type "CO" Self-Opening Die Head

WHETHER it's a question of size, tolerance or production, Murchey threading equipment covers a wide range in cutting external or internal threads.

The new #42 Murchey Thread Milling Machine extends the range into the zone of larger diameter threads from 4" to 12", external or internal, right or left hand, where extra accuracy is needed.

The use of full-length annular milling cutters, and accurate control of pitch and depth produces precision-cut threads at a production rate which will interest you.

Murchey also manufactures all types of Collapsible Taps, Self-Opening Die Heads and Shell Tapping Machines

MURCHEY MACHINE & TOOL COMPANY

DETROIT, MICHIGAN

The Tropenas Converter In a Light Casting Foundry

(CONTINUED FROM PAGE 102)

lumps in water and throwing them with force through the mouth of the converter, relying on the wet manganese to explode the covering of slag and penetrate into the metal. The loss of manganese is approximately 30 per cent, 1.40 per cent being added to finish at 1.0 per cent. The metal is then well rabbled with a bar to work in any manganese that may have been trapped by the slag.

The carbon is adjusted, when necessary, by the use of cupola metal. This method of recarburizing is easily adaptable, quick and efficient, hot hand-shanks of predetermined capacity being used. The actual time taken to recarburize a heat is 3 min. After recarburization, the vessel is turned up to within a few degrees of the blowing position (in order to obtain the maximum movement of the metal) and back again to the pour-in position, then rabbled well with a bar to insure homogeneity. The ladle is brought into the pit and the slag is held back to insure that the aluminum which is added to the ladle will be taken up by the metal, after which the slag is allowed to run freely. The tapping temperature of converter metal compares favorably with that produced by the electric furnace. Shanking heats are tapped at 3020 deg. F., and bottom pouring heats at 2912 deg. F. Table II gives details of pouring temperatures and times.

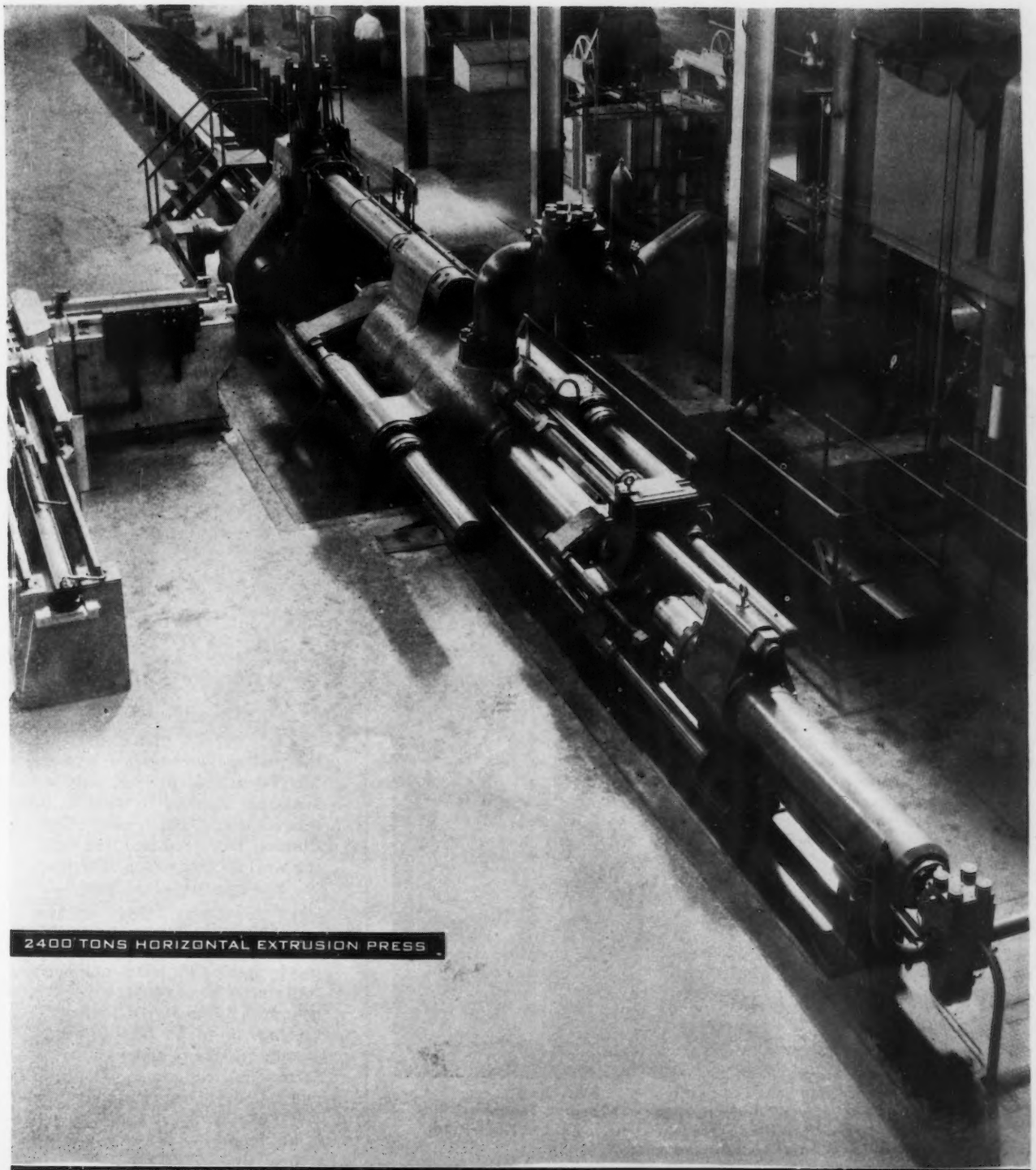
Preparation of Converter

The bottom of the converter vessel is made up of three courses of 3-in. silica bricks. A well known proprietary material is used for the walls, which are rammed round a wooden former, 27 in. across by 51 in. high, sectional in construction to facilitate removal. The vitrified and burnt material is chipped off the face, leaving about 1½ to 3 in. old material round the shell. This is slurried down and the new material rammed into place with pneumatic rammers. The vessel is allowed to stand, drying naturally for as long as possible before being put into work.

Drying and heating are conducted as follows: A small coke fire is started and allowed to burn slowly for 15 hr., additions of coke being made as required. After 15 hr. approximately 560 lb. of coke are added and air blown in through the tuyeres at 1½ lb. per sq. in. pressure. After blowing once up and down, a further 224 lb. of coke is added and the blowing repeated. Blowing up and down is maintained for 30 min. in each operation; the vessel is then allowed to hang nose downwards with the tuyere box open. The daily practice is similar. After the nose has been made up, a fire is started at 8 A. M. and alternate blowing up and down the hood takes place at 30-min. intervals. The vessel is then turned down until the coke is withdrawn. Coke consumption increases as the size of the vessel increases and reaches a maximum of 1120 lb.

Table III details the chemical composition and physical properties of two heats of converter steel after normalizing from 1652 to 1688 deg. F.

(CONTINUED ON PAGE 184)



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The question of the relative fluidity of converter and basic electric steel is often discussed. It is usually held that converter steel is more fluid than basic electric steel. In the experience of the authors, temperature is by far the strongest factor in fluidity. Temperature readings over a considerable period have shown that converter steel is consistently 70 deg. to 110 deg. F. hotter than electric steel. The authors believe that with well made steels the difference in fluidity of the two types of steel at the same temperature is very small.

Non-fluid steels are occasionally encountered and, in the case of electric steel, this is usually found to occur in heats on which the boil has been unsatisfactory. This is often followed by a prolonged period under the final reducing slag. The steel is frequently found to be high in Si and to contain considerable inclusions. In no discussion on fluidity has any reference been found to non-fluid converter steel. Yet this occasionally occurs. It appears to be associated with cold iron in the converter charge and an extended period before the boil begins. A very fluid and sloppy slag high in FeO is formed and it appears that this results in a high proportion of non-metallic inclusions. It would be interesting to know if there is any definite evidence that lack of fluidity is associated with the presence of inclusions.

Occurrence and Production of Molybdenum

(CONTINUED FROM PAGE 107)

vantage of possible large volume. The deposit at Azégour, French Morocco, is contact metamorphic, and for this reason development and production reported there is of some interest. In the United States, a small amount was taken from a contact-metamorphic deposit near Bishop, Cal.

Orthodox Mining Methods

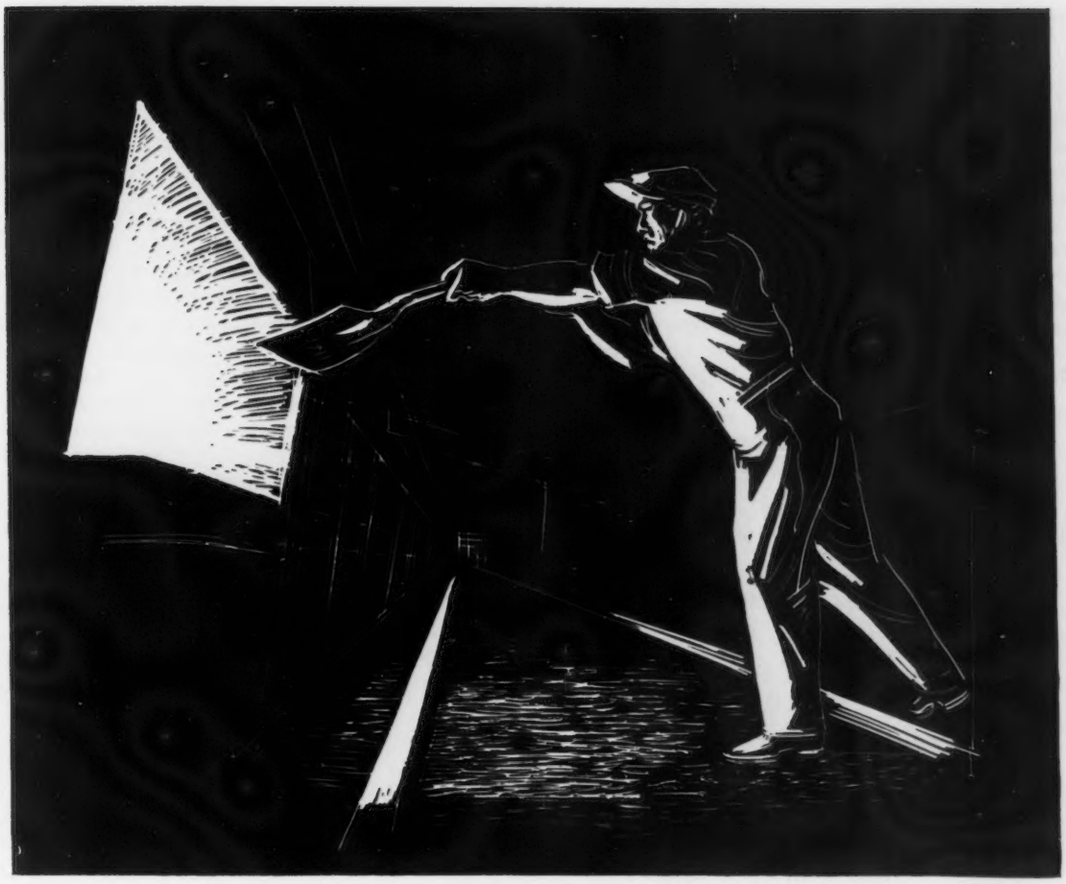
The hypothermal and mesothermal occurrences are numerous. Molybdenite is present only as an accessory mineral in most of these occurrences, but one deposit, Climax, has produced the bulk of the world's production. The Questa, N. M., deposit also falls in this class.

Molybdenite has to be roasted for conversion to three forms for adding to steel: (1) ferro-molybdenum containing 50 to 65 per cent molybdenum; (2) calcium molybdate containing 45 to 50 per cent molybdenum; (3) molybdenum trioxide formed in briquettes. Flotation of molybdenite is a relatively simple metallurgical operation. Its separation from copper was considered difficult until recently.

The similarity in methods of mining and concentration and resulting costs makes it possible to determine the potential value of an occurrence of molybdenite by the same engineering methods of evaluation used in the examination of deposits of gold, silver, copper and other metals. If full use were made of this fact by those searching for molybdenite deposits, much energy could be saved and unnecessary disappointments could be avoided.

During the first World War and

(CONTINUED ON PAGE 186)



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ARMY E NAVY

From acid open hearth to finished forging, the processes of steel making at Standard are under rigid, painstaking control. Especially trained metallurgists and chemists carefully analyze the materials used in Standard products safeguarding the high quality which is a "must" with every forging delivered to a Standard customer.

In forgings, castings, weldless rings, steel wheels and many other steel products the name Standard is an assurance of dependability and long service life.

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PHILADELPHIA

earlier, wulfenite ($PbMoO_4$) was an important source of molybdenum. Today wulfenite is of minor importance, even though on a tonnage basis as much may now be produced annually as in 1918. The known reserves of wulfenite are small, and it is doubtful that the present rate of production of wulfenite in the United States as well as in central Europe and Russia will be maintained after the present war.

Wulfenite is a nonmetallic mineral; it usually forms thin squares to prismatic crystals, but may also occur massive without crystal form. Wulfenite is found in the oxidized parts of lead deposits. Its origin is not well understood, because the source of molybdenum has not been found. The mineral is common in Arizona, New Mexico, South America, northern Africa, Spain, central Europe and Russia. It is believed to be formed by molybdenum-bearing thermal waters coming in contact with oxidized lead deposits.

The largest of the Arizona deposits is at Schultz, near Mammoth. Initial production, 1881 to 1912, was entirely gold, but from 1916 to 1919 wulfenite was saved and yielded nearly 500,000 lb. of molybdenum. The old tailings were also reworked for their wulfenite. The present operation, which began in 1934, has been recovering gold, silver, lead, molybdenum and vanadium, the last two at a rate of about 100,000 lb. annually from wulfenite and vanadinite respectively. It is estimated that not less than 2,000,000 lb. of wulfenite has been recovered at Mammoth, and in addition much has been lost and much is present in low-grade ore and cannot be recovered. Production of wulfenite from this mine in recent years has been possible because of improvements of milling which permit the recovery of vanadium and gold as well as molybdenum.

Similar in character to the Mammoth deposit and second to it in size is the deposit of wulfenite at the old Yuma mine in Pine County, near Tucson, Ariz. The vein in the Yuma mine is 8 to 20 ft. wide. Locally, small amounts of gold are found included in wulfenite crystals.

Molybdite is easily recognized. It occurs as fine, needle-like crystals. The association of molybdite and molydenite is general; in fact the absence of molybenite has never been noted where molybdite has been found.

Molybdite has never been a source of molybdenum, although apparently feasible methods for its recovery have been worked out. The chief difficulty in its recovery is its fine grain and the fact that as it is soft and brittle, it becomes extremely fine even with moderate grinding. Also, since it is an oxide the flotation methods applied to the sulfide are not effective. Molybdenite resists oxidation so that molybdite is not developed in quantity except close to the surface. This limited development is against molybdite ever becoming an important source of molybdenum. The proportions of its composing elements vary, so that no specific formula for it can be written.

Molybdenum production, as previously stated, has come from rela-

(CONTINUED ON PAGE 188)

tively few mines, and a review of these deposits is of particular interest, because they have had considerable mine development in recent years.

The largest producer, contributing more than half the world's output, is the Climax deposit, about 100 miles west of Denver on Fremont Pass, at an altitude of 11,320 ft. Mining began in 1917 and was discontinued in 1919. In 1924, mining was resumed at a rate of a few hundred tons of ore per day, which had grown to about 10,000 or 15,000 tons per day in 1941, yielding some 20,000,000 to 25,000,000 lb. of molybdenum annually. Ore reserves are estimated at over 140,000,000 tons.

Iron stained outcrops over an area nearly a mile in diameter mark the mineralized area at the surface. Mineralization is characterized in the upper horizon by extensive fine-grained quartz replacement of granite and schist over a circular area 1,000 to 1,500 ft. across. Encircling the quartz is an ore zone 300 to 500 ft. wide, characterized by secondary fine-grained quartz veinlets carrying most of the molybdenite, some of which occurs in scattered grains. Mineralization, including molybdenite content, gradually decreases outward or away from the area of quartz replacement. Small molybdenum content is found across a distance of over 1,500 ft. outside the ore zone.

For mining the ore, a system of underground caving has been developed. Mine workings and diamond drilling have partly developed the mineralized area to a depth of about 2000 ft. below the outcrop. No change in the character of mineralization is indicated. It should be pointed out that most of the development consisting of mine workings and diamond drilling is concentrated in a vertical interval of about 1000 ft. below which diamond drilling is the only source of information. Therefore, the information regarding lower horizons is incomplete and considering the horizontal extent of over 4000 ft. of mineralization, the depth of exploration is relatively small.

The mining methods are described by Coulter[2] and numerous other descriptions of various phases of the operation have appeared from time to time in the mining journals.

Questa is a small village in the western foothills of the Sangre de Cristo Range, in Taos County, N. M. The veins are in Sulphur Gulch, a tributary of Red River, and are about seven miles east of Questa. The deposit, while a typical vein, is the only known vein of its kind to have produced large quantities of molybdenum. The total production from 1921 to the end of 1941 has been 13,711,661 lb. of molybdenum. A little molybdenite was produced in 1918-19, when the mine closed down until 1921. It is now operated by Molybdenum Corp. of America. With the small veins, the mining is more selective than that of Climax. The methods have been described by Carman.[3]

Mineralization is in fissure veins near the contact of a small stock of albite granite, circular in plan and only a few miles across at the surface, but enlarging downward. Mineralization is confined to a relatively small area, about 100 by 2000

(CONTINUED ON PAGE 192)

ft. The ore is a vein filling, varying through widths of a few inches to several feet. It is very seldom that a vein large enough to be mined has been found outside the granite.

Copper-Molybdenum Mines

The only other molybdenum producers in this country, of any importance, are copper mines, in which molybdenum is a byproduct. As can be seen from Table I, however, these deposits account for almost a third of our production.

The copper orebody of the Utah Copper Co. at Bingham, Utah, is one of the largest low grade copper mines of the world. Recovery of molybdenite began there in 1936 and since then the Utah Copper Co. has been second only to the Climax Molybdenum Co. in the quantity of molybdenum produced. Exact figures on production are not available, but the 1941 yield was probably eight to ten million pounds of molybdenum content in concentrates. The molybdenite content of the ore is said to be 0.02 to 0.04 per cent or 0.4 to 0.8 lb. of molybdenite per ton. Recovery of so small a quantity is possible because of the ready flotability of molybdenite, which collects with the copper sulfide concentrate. Thus the copper concentrates become the molybdenite ore. The cost of recovering the molybdenite lies largely in its separation from the copper sulfides, not an overly difficult or complicated process.

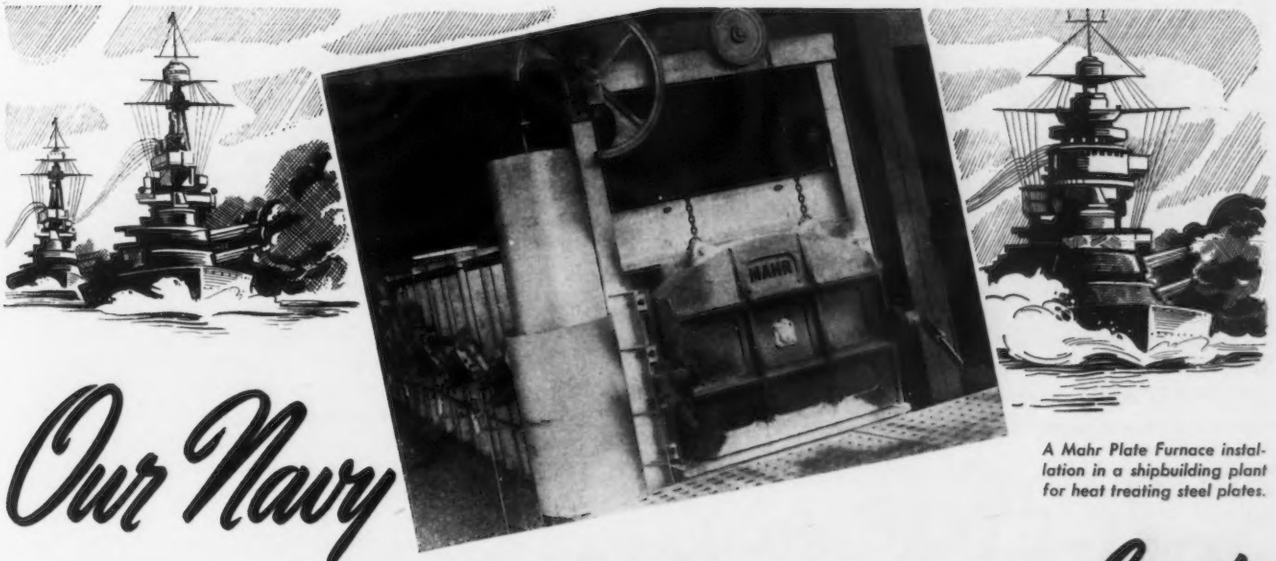
The molybdenite seems to be distributed widely, but it shows up more often in a zone marked by quartz veins and where the strongest copper mineralization is said to occur also. Some of the quartz veins are sufficiently large and show so much molybdenite, that at one time selective mining was considered but decided against because of the spottiness of the molybdenite in veins.

The Chino, N. M., orebody occurring near Santa Rita, N. M., is similar in many respects to that of the Utah Copper Co. mine. Molybdenite production began in 1939, and annual output is probably under a million pounds. The overall average of molybdenite content, based on values recovered, is said to be less than at the Bingham copper deposit.

At Miami, Ariz., molybdenite production began in 1939. The amount produced is not known, but the grade of ore reported is 0.18 lb. of molybdenite per ton of ore. Again the occurrence of molybdenite is similar to the occurrence noted for the disseminated copper in porphyry in Utah and New Mexico.

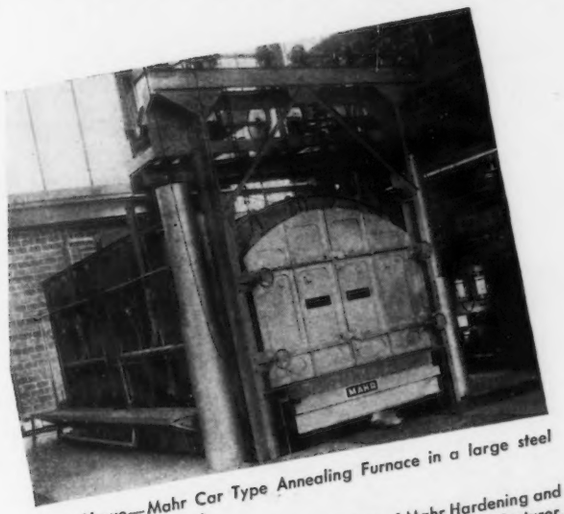
This completes the roster of all important molybdenum producers in this country, but mention should be made of Copper Creek, Ariz., and Urad, Colo. As can be seen from Table I, Copper Creek was a fairly large producer from 1935 to 1939. Molybdenite was discovered incidental to exploration for copper during the first World War, but development was not attempted before about 1933 or 1934. The total production was several million pounds with a minor amount of copper byproduct. Though more than 100 breccia pipes occur in five to six square miles, molybdenite is restricted to a few. The ore probably averaged less than one per cent molybdenite after considerable

(CONTINUED ON PAGE 194)



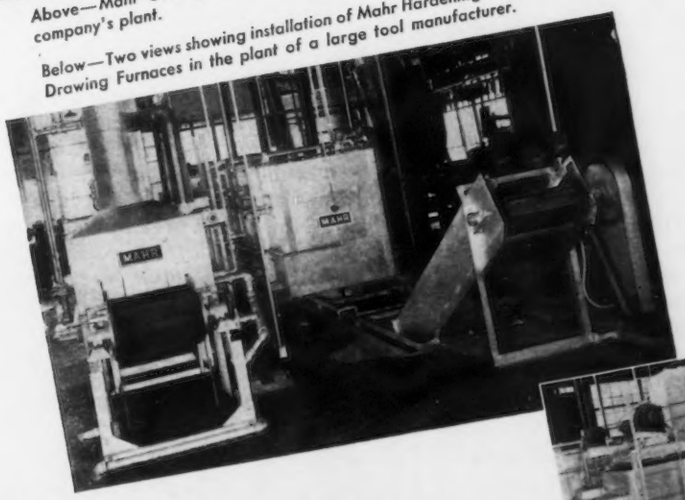
A Mahr Plate Furnace installation in a shipbuilding plant for heat treating steel plates.

Our Navy GIVES 'EM "HEAT TREATMENTS" plenty



Above—Mahr Car Type Annealing Furnace in a large steel company's plant.

Below—Two views showing installation of Mahr Hardening and Drawing Furnaces in the plant of a large tool manufacturer.



On the seas, it's our armor plate versus bombs, shells, torpedoes—and vice versa! Our Navy is manned by men of courage, high morale, GUTS! They deserve the toughest armor plate (and the best arms and shells) in the world—and they're getting them.

We like to feel we're really giving the Japs "heat treatments", with hundreds of MAHR Furnaces in use 24 hours a day, carburizing armor plate for greatest strength and toughness—and with many other kinds of accurate heat treatments helping to perfect every type of steel needed on America's warships . . . The modern science of heat treating metals is receiving its fullest expression and creative development in

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	Furnace Types:	*Other MAHR Equipment:*
ANNEALING	CAR BOTTOM	RIVET FORGES
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sorting underground. With depth, the cross section of the pipe decreased to a size that yielded an insufficient volume of ore for profitable mining, and the mine was forced to close. The pipe had been developed and mined to a depth of about 850 ft.

Urad, about 10 miles above Empire, Colo., was one of the mines which was never reopened after the first World War. Several hundred thousand pounds of molybdenite was produced, and there remained a considerable amount of one per cent ore. In August of this year, Urad was bought by the government for $110,000 and will be developed and operated by Molybdenum Corp. of America.

Large Foreign Producers

Important producers outside of this country include Knaben, Norway; Azégour, French Morocco; Cananea, Sonora, Mexico, and Braden, Chile. The two latter are byproduct mines.

The important Knaben deposits are in southern Norway, west of Kristiana. Production dates as far back as 1880, but was irregular until 1910; and by the end of the first World War 15 larger and smaller deposits were being worked. The three most important were the Knaben mines, the A/S Kvina mines in Tjotland, and the A/S Dalen mines in Telemarken, each of which had produced over 100 metric tons of molybdenite by 1917. Production was resumed after the war and has continued to the present.

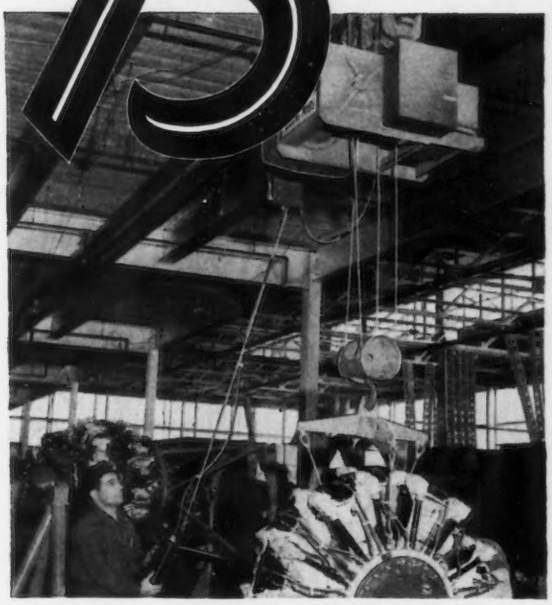
The first recorded production of molybdenum at Azégour was in 1933, and the last available report estimates a possible production of 250,000 lb. in 1938. An expected average grade of one to two per cent is estimated, suggesting an eventual large production. The contact zone is 500 miles long and about one mile wide. It is obvious that a zone of the extent mentioned above might be capable of a large production, and if the deposits are being exploited by German steel interests, as reported, the largest possible production is to be expected. However, the history of contact deposits of this type suggests spotty erratic occurrence rather than large orebodies. It will be interesting to watch Azégour to see if the development of the molybdenite proves different from the average contact-metamorphic deposits.

Cananea was the first of the copper orebodies to produce molybdenite as a byproduct. The principal production from the Cananea district is copper, and early discovery was made easy by conspicuous outcrops of ore. After the exhaustion of the older mines a drilling program was followed to explore a large low-grade area of copper mineralization, and this resulted in the discovery in 1926 of the Colorado orebody beneath several hundred feet of relatively unmineralized rock. Recovery of molybdenite as a byproduct did not begin until 1933 and has continued at an annual rate of about 1,250,000 lb. of molybdenum contained in concentrates. In 1934, the average mill heads were fixed by controlled mining at about 7 per cent copper, said to contain about 0.7 per cent molybdenite.

At Cananea, molybdenite has been produced only from the Col-

(CONTINUED ON PAGE 196)

73 R & M HOISTS Speed these Firms' War Work!



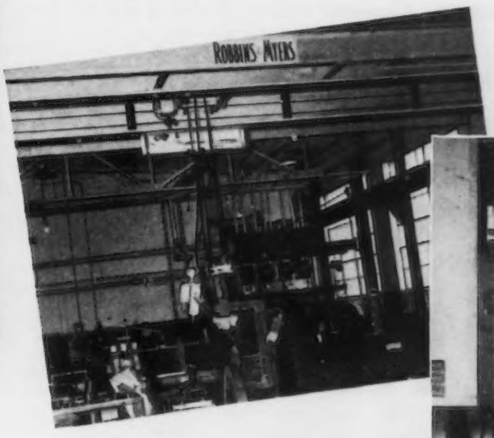
Fighter-plane engines travel by R & M "air express" in a major aircraft plant.

You can tell by a glance at these photographs that the lifting and conveying ability of R & M Hoists is an *important* factor in the war production performance of American industry. In *plants* of all types they're doing *jobs* of all types —with utmost speed and utility—with a minimum of maintenance delays and expense.

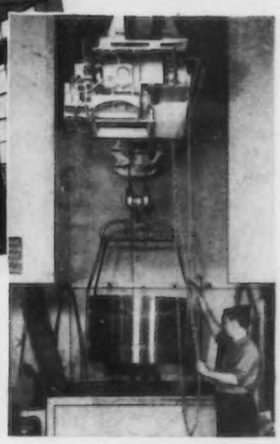
The features for which production men select R & M Hoists are features *you* should insist on. To name a few, they're all powered by famously dependable R & M motors; they're *compactly designed* to provide utmost plant headroom; they're *precision-built* to give years of efficient service; they handle loads from *any* angle, with perfect balance. There are hundreds of different models in the R & M line—ranging in capacity from 1000 to 15,000 lbs.—to fit every application.

Whatever *your* hoisting problem, "take it up" with R & M! Our expert representatives will help you find the solution. Call the nearest R & M sales and service office, or write us at the factory.

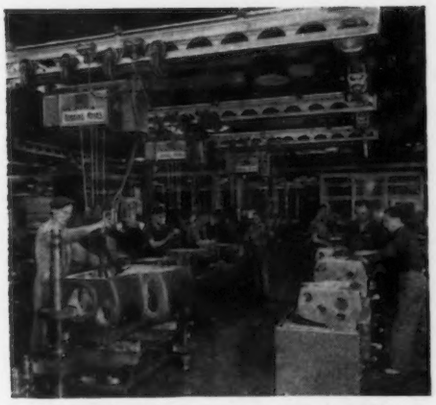
Speeding metal salvage for a well-known screw and bolt maker is the job of this R & M winch-type hoist.



R & M Hoists help boost vital steel output for a front-rank steel mill. ←



One of many jobs R & M Hoists perform for a top-flight bearing maker is slushing 5300-lb. bearings. →



For a leading machine tool maker, R & M Hoists speed work and save man power.

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orado orebody, and early descriptions of the district do not list molybdenite; however, small amounts of molybdenite were found by the writer after only a brief search on each of the dumps of the large old mines. It is safe to say that the molybdenite is widespread in small quantities in the old mines, but unfortunately its relation to other sulfides is obscure.

The volume and extent of molybdenum distribution at Braden, Chile, have not been made public. In 1939, the Braden Copper Co. made a small production of molybdenite in an experimental plant, and 800 to 900 tons of molybdenite concentrates were reported in 1940.

In addition to the important molybdenum sources of the world, named above, there are deposits which can produce a little molybdenite, most of them only when prices for the metal are abnormally high. The more important of these are in the United States, Canada and Australia.

In the United States, molybdenite has been produced from a few quartz veinings chiefly in Arizona, Colorado and Alaska with a small amount from a contact-metamorphic deposit near Bishop, Cal. Production of molybdenite from wulfenite at Schultz, near Mammoth, Ariz., and the old Yuma mine near Tucson, has already been mentioned. Schultz is now operated by the St. Anthony Mining & Development Co.

In Canada, though other and smaller deposits similar to that of the Moss or Wood mine, previously mentioned, have been worked, the quantity of molybdenite that could be produced from these sources would be relatively insignificant.

The Australian deposits are in Queensland, New South Wales, and Victoria, with small occurrences in each of the other states also. At Victoria, the rock mined containing less than one per cent molybdenite was treated as waste. Hand picked ore containing 10 per cent molybdenite was shipped to Melbourne, but production was small, coming from quartz veins one foot or less in width.

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Briggs Air School Graduates First Class

Detroit

• • • **Briggs Mfg. Co.** has graduated the first class from its Air Force Training School, after a training period of five weeks. Several hundred men are attending this school, located in the old Briggs "Roosevelt" plant formerly used to make automobile body forgings. Since aircraft turret manufacture was transferred from this plant to a new factory, the building has been made into a complete technical school unit where men are trained to maintain any kind of aircraft turret.

COMING EVENTS

Oct. 5 to 6—National Machine Tool Builders' Association, New York.
Oct. 7—Associated Machine Tool Dealers of America, New York.
Oct. 7 to 10—The Electrochemical Society, Inc., Detroit.
Oct. 9—Gray Iron Founder's Society, Cleveland.
Oct. 12 to 16—National Metal Congress and Exposition, Cleveland.
Oct. 12 to 16—American Welding Society, Cleveland.
Oct. 12 to 16—American Institute of Mining and Metallurgical Engineers, Cleveland.
Oct. 12 to 16—Wire Association, Cleveland.
Oct. 12 to 16—American Society for Metals, Cleveland.
Oct. 15 to 17—American Gear Mfrs. Association, Skytop, Pa.
Oct. 15 to 17—Federation of Sewage Works Association, New York.
Oct. 16 and 17 — War Production Conference of American Society of Tool Engineers, Springfield, Mass.
Oct. 18 to 21 — American Public Works Congress, Chicago.
Oct. 20 to 22—American Railway Bridge and Building Association, Chicago.
Oct. 27 to 29—National Safety Congress Association, international convention, Chicago.
No. 17 to 22 — National Chemical Exposition, Chicago.
Nov. 30 to Dec. 3—American Society of Mechanical Engineers, annual meeting, Hotel Astor, New York.
Nov. 30 to Dec. 4—National Exposition of Power and Mechanical Engineering, New York.

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	Main Frame	Main Shaft	Main Bearings	SlideAlignment	Lubrication	Drive
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Forging Presses	Integral solid steel with four liberal solid columns and deep crown rib	Heat treated, forged alloy full eccentric type	Solid sleeve type with wedged fit in continuous housings	Ram rear extension guided with front cover plates tongued into frame	Single station, pressure type—automatic on larger sizes	Patented, direct-acting air clutch double-draft ventilated
Forging Rolls	Steel main housings with steel top roll housings tongued in for adjustment	Heat treated, alloy steel casting with die seat and roll necks integral	Solid sleeve type in continuous housings labyrinth sealed against scale and water	Vertical and longitudinal housing adjustment and die lead adjustment	Alemite hand gun grease with fittings at shoulder height	Patented, direct-acting air clutch double-draft ventilated
Benefits	*Anvil-like rigidity holds forgings accurate with low finish allowance*	*Absence of deflection holds forgings to close thickness tolerance*	*Support main shaft against deflection on dead center where stresses reverse*	*Maintains accurate die match, prolongs piercer life, holds forgings accurately concentric*	*Decreased down time and repairs—maintains uninterrupted production schedules*	*Decreases operator fatigue — increases production — decreases production costs*

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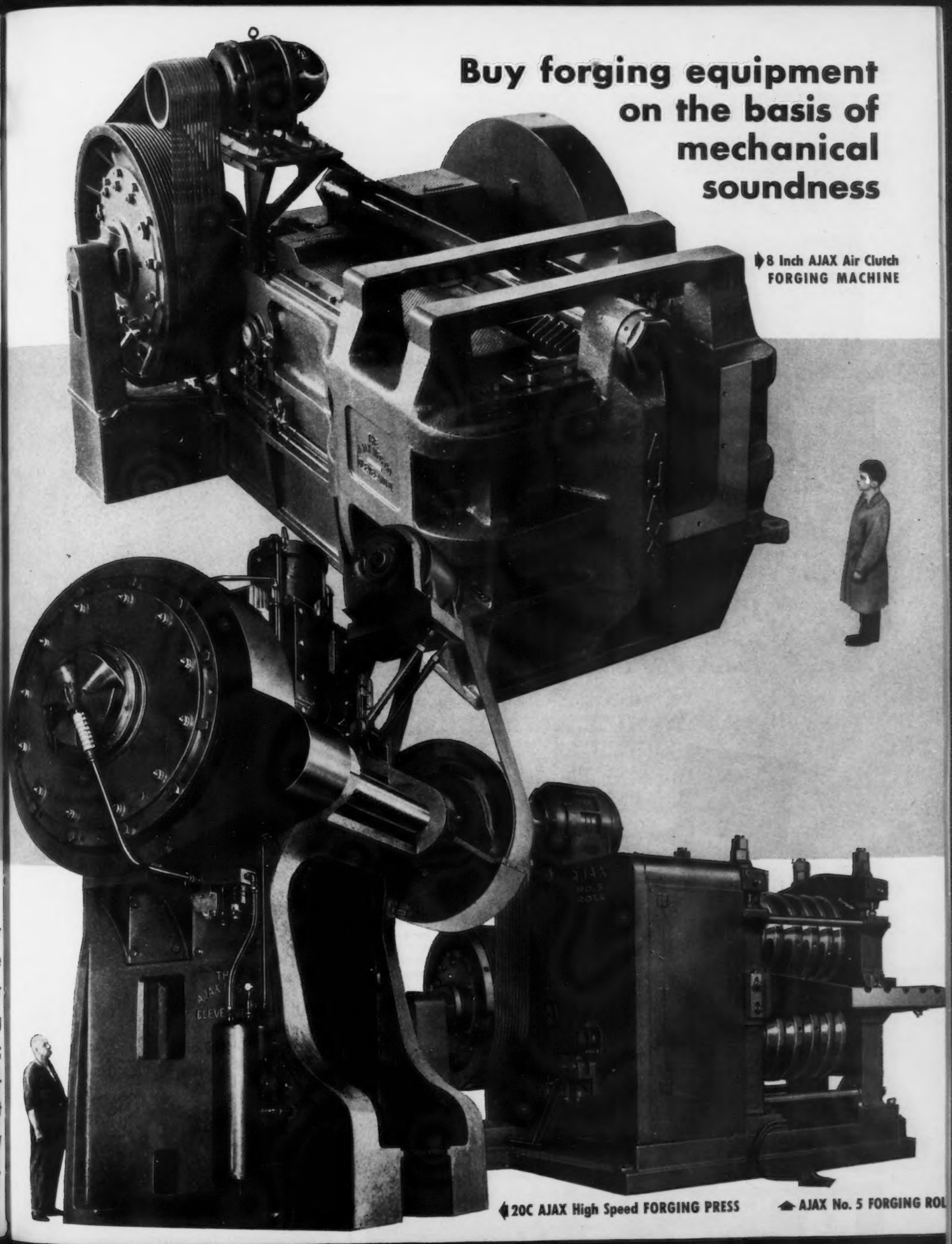
• BAR DRAWING AND STRAIGHTENING MACHINES • WIRE DRAWING, STRAIGHTENING AND CUTTING OFF MACHI



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LABOR HIGHLIGHTS

- *Longer Working Hours Hinted*
- *Labor-Control Act Favored*
- *"Work-or-Fight" Action Used*
- *WLB Disavows 15% Limit*

o o o

• • • At least three trends are developing on the labor front this week. One, the beginning of agitation for longer working hours; two, a second pronouncement in favor of a national service act to control labor by government edict; and three, a movement toward a "work-or-fight" action through the Selective Service Act.

Harold L. Ickes, coordinator of solid fuels, last week called a meeting of coal producers and labor representatives to consider increased working hours in the nation's coal mines. Mr. Ickes, eyeing the United Mine Worker's CIO present 5-day, 35 hour week is expected to ask for a 6-day, 42-hour week when the meeting assembles this week in Washington. Last week THE IRON AGE intimated that war production requirements might soon bring consideration of the 10-hr. day in the steel industry. This instance in the mining field is the first real evidence that longer hours are in for official consideration.

Following closely on the heels of a declaration by Paul V. McNutt in favor of a national service act to control labor's movements comes a pronouncement by Secretary of Agriculture Wickard in the same vein. Mr. Wickard, perturbed over the fact that the draft and the temptation of higher wages are draining manpower from the farms, suggested before a House Agricultural Committee that a national service act should be given consideration. Showing the scope of Mr. Wickard's thinking in making such a suggestion he said, "It is not simply a question affecting agriculture, it is a question which affects the entire war effort."

Considering that Canada, which has pointed the way in other matters, has just put such a bill into effect and that federal employees are already under strict control, there seems little doubt but that a labor-control bill will find its way into legislation in the not too far future.

The "get tough" theory is starting to be applied to absenteeism in the form of a "work-or-fight" edict pronounced almost simultaneously by Major-Gen. L. B. Hershey, selective service director and Brig.-Gen. Ben M. Smith, Alabama's selective service director.

Hershey, in a press statement made in Washington last week warned miners and all other deferred workers that those who took frequent days off for unexplained reasons would risk being drafted in the future. Hershey explained that the selective service regulations provided that when a deferred registrant "is not support-

Conserving High Speed Steel.....

. . . it's an old story at Genesee

Long before limitations were placed on the use of High Speed Steel (18-4-1), the makers of "Tomahawk" tools were already regularly producing cutting tools made up of H.S.S. tips on soft steel shanks.

Such "Tomahawk" tools were being used in regular production by one of the largest automobile manufacturers, for instance, as far back as 1938.

Production quantities were not large —in those days there was no tungsten shortage—but it did provide Genesee with the essential production background to produce such tools when suddenly needed in quantities.

That has been and will continue to be one of Genesee's policies:— to be ready with new forms of "Tomahawk" quality tools, standard or special, for any set of conditions, — for war or for the peace to follow.

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ing or is adversely affecting the war effort or the national health, safety or interest" the offenders may be called up for reclassification by the local draft board. This is expected to be enforced in the near future.

First real evidence of enforcement of the "work-or-fight" policy came with the flat statement of Alabama's selective service director, Ben M. Smith who asserted that he was instructing all Alabama draft boards to reclassify all men who walked out on any defense job. Mr. Smith said, "No man is deferred in the draft because of a personal favor. The deferment is granted because a worker is engaged in vital war industry. When the worker strikes, he has lost his deferred status if he stays out as long as 24 hours."

Backing this statement with action, Mr. Smith directed Mobile county draft boards to reclassify 70 men who walked off a road job at an air base.

•

WLB Takes New Wage Stand

Washington

• • • **The WLB took** an entirely new wage stand, according to the conceptions of most of us, when William H. Davis, chairman asserted that the board was "not going to tie its hands behind its back" and never approve any wage increase in excess of the "little steel" 15 per cent basis. The issue came up as a result of a mediation panel's recommendation that copper, lead and zinc miners in Idaho and Utah receive a $1 a day wage increase. The board is clearing the way to grant a raise of this size, if deemed necessary, to prevent the migration of these workers to higher paying fields.

•

Wright Union Fate Up to WLB

Washington

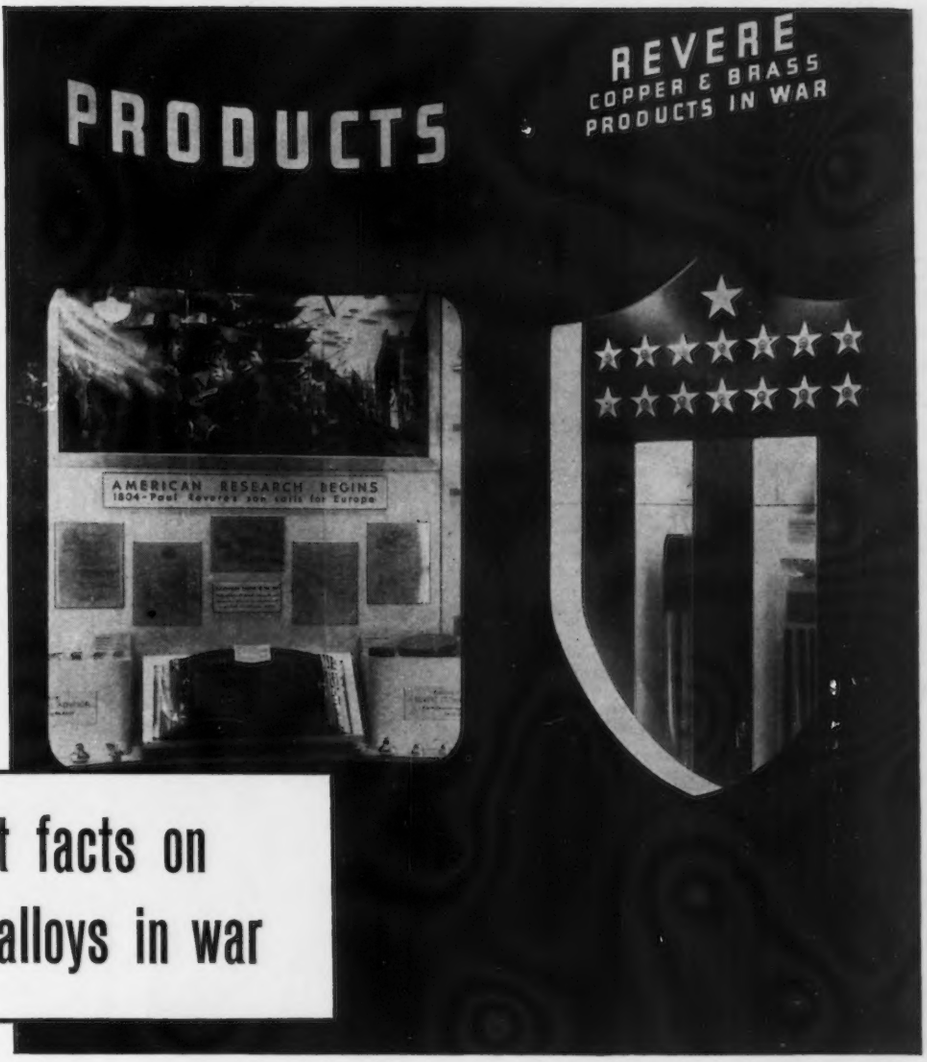
• • • **The NLRB completed** hearings of the CIO's complaint against the Wright Aeronautical Corp.'s independent union in three hours during which disestablishment of the independent union was asked. The findings will be referred to the War Labor Board for final ruling. The attorney for the independent union (Wright Aeronautical Employees Assoc.) waived customary presentation of evidence and cited an election in May when the workers voted it as their bargaining agent.

•

Alcoa Hit by Labor Trouble

Cleveland

• • • **A production crippling strike** closed in on the smelter division of the Aluminum Co. of America Sept. 22, when 75 men who operate the smelter walked out and were soon joined by 100 men on the day shift and 50 on the second shift. Army Air Force investigators said they were informed that the strike was called because the smelter workers were not affected by a bonus increase awarded to 600 Alcoa forge-shop employees. The smelter shut-down affects 7000 other employees who depend on the smelter for material. It was re-



Get the latest facts on copper-base alloys in war

From October 12th to 16th, the National Exposition of the American Society for Metals in Cleveland will spread before production executives and technical men the complete story of metals in war.

New developments, concrete examples of improved and new products, technical information, ways of beating schedules, use and availability of products, substitute materials, conversion to war production —all of these will be presented in the way that can help you most.

The Revere exhibit covers the field of copper and copper-base alloys. It is manned with technical and production men, who are able to give you the kind of information you can put to immediate use.

If you are unable to come to Cleveland, remember that the Revere Technical Advisory staff is always available to place such information before you, to answer difficult questions and to work out practical solutions to your copper and copper-alloy problems.

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ported that union shop stewards were pleading with the men to return to work and that the Mine, Metal and Smelter Workers Union (CIO) disclaimed any responsibility for the walkout.

•

Coal Foremen's Union Seeks Recognition

Pittsburgh

• • • **Although the NLRB** has ruled that the Mine Officials Union of America is a proper labor organization for collective bargaining, the western Pennsylvania Coal Operators Association has announced that its member companies will not recognize the new group until its legal status is determined by courts.

Preliminary conferences had been held between the Independment Mine Officials Union of America which represents assistant foremen, fire box bosses, weight bosses, coal inspectors, and other supervisory employees, and the coal association. The NLRB last week had certified the MOU as a proper bargaining agency in a case involving the Union Collieries Co. of Oakmont, Pa.

The latest snag in the mine boss union's attempt to obtain contracts on an industry wide basis will probably not be settled until the local courts determine the group's legal status. The coal operators, in refusing an industry wide recognition, contended that the NLRB has determined that the association does not represent various companies in collective bargaining in respect to these managerial officials, that the NLRB has incorrectly interpreted the Wagner Act by including supervisory officials as employees under the act, and that the mine Officials Union statement indicates a proposal to bargain collectively for all supervisory forces while the NLRB's decision covers only four classes out of a large number of managerial officials which the union claims to represent.

Draft Boards to Reclassify Strikers

Montgomery, Ala.

• • • Following a walkout of some 70 AFL workmen on an army road construction project at Mobile, Brig. Gen. Ben M. Smith, director of Selective Service in Alabama, ordered Mobile County draft boards on Sept. 23 to reclassify all men engaged in the walkout.

Gen. Smith asserted that the Selective Service System in Alabama planned to reclassify "every defense worker in Alabama who stays off his job as long as 24 hours.

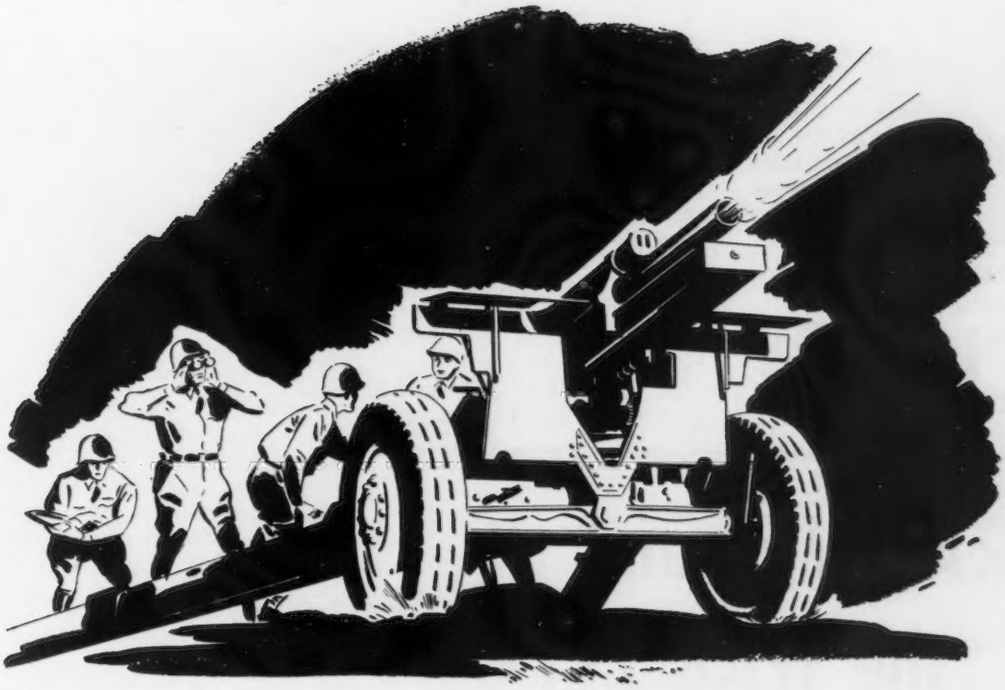
"You can quote me emphatically as saying we plan to reclassify all defense workers who strike. I am sick and tired of this strike business," he said. "No man is deferred in the draft because of personal favor. The deferment is granted because a worker is engaged in vital war industry."

•

313,000 on G-M Payrolls

New York

• • • **General Motors Corp.** reports that it has approximately 313,000 workers on its payrolls, topping all peacetime records and comparing with its



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previous peak of 291,808 in June of 1941.

Of the total employed, 254,000 are hourly workers and 59,000 are salaried workers. Approximately 12 per cent of the hourly workers are women.

•

Strike Cost 18,500 War Man-Hours

Jackson, Mich.

• • • **A new form of labor** disturbance came to its end last week when more than 500 employees of the Muskegon Motor Specialties Co. returned to their jobs after quitting five days earlier.

The difficulty, as yet without a name, began when 50 finished grinders quit in a group following refusal for a pay raise demand to $1.35 an hour on piece work and $1.25 an hour day rate. The next day 85 finish and rough grinders quit and the rest turned in their tools and walked out in the succeeding two days. Officials of UAW-CIO Local 953 denied that they had inspired the walk-out. Some employees were quoted as saying they did not want to quit, but did so when other union members turned pressure on them to walk out and join the drive for a wage raise. The entire plant has been active on war work almost exclusively, and it was estimated that the walk-out cost the war effort some 18,500 man-hours of work.

•

Recognition

• • • **The picture showing** the dismantling of a railroad train shed on page 98, Sept. 17 issue of THE IRON AGE, was obtained through the courtesy of the United Iron & Metal Co., Pittsburgh.

•

Wins NLRB Election

Pittsburgh

• • • **United Steel Workers** of America won an NLRB election here last week at the Shiffler Plant of the American Bridge Co., thirty-four employees voting for the USWA and none voting for non-representation.

The regional office of the NLRB which has supervised all U. S. Steel subsidiary elections, will open hearings Sept. 30 at Birmingham, Ala., on the petition of the USWA for certification as exclusive collective bargaining agent at six plants of the U. S. Steel subsidiary, Tennessee Coal, Iron & Railroad Co. The certification is being contested by three A. F. of L. unions and two independent unions.

•

Buffalo Payrolls Hit New Peak

• • • **Factory employment** and payrolls in buffalo swung to new all-time records last month. An analysis by the local Chamber of Commerce shows employment in 173 plants was 10.4 per cent above the same month a year ago while payrolls soared 33.3 per cent. Figures show a gain of 381 workers from the July total and 11,060 more than in August, 1941.

•

Federal Overtime Pay Asked

Washington

• • • **William Green, president** of the American Federation of Labor, testifying before a Senate committee on a bill destined to standard-

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PORTABLE BIN
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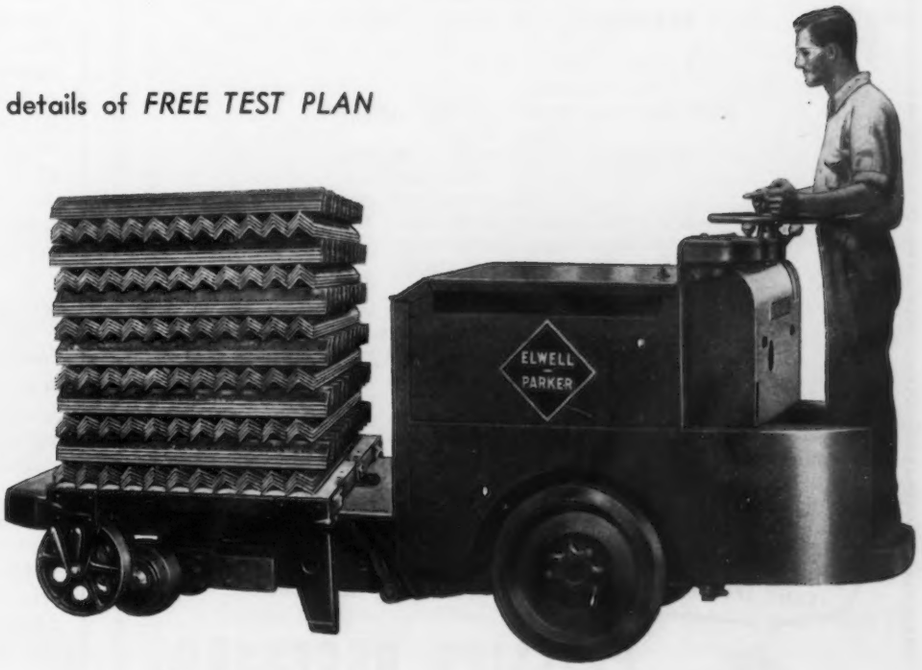

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MILWAUKEE WISCONSIN

ize overtime pay of federal employees, declared himself in favor of the legislation and pointed out a number of instances of inequalities. He stated that the government should be the "ideal employer" showing the way for industry and at the same time said that industry was, in many instances, actually doing the leading by establishing suitable overtime when and where it was needed. The bill is intended to more nearly equalize the pay of government employees with the wages of private industry and act as a stop gap to the migration of federal workers to private industry.

•

CIO-Bethlehem Contract Boosts Shipyard Pay

New York

• • • **A new contract** entered into by Bethlehem Steel Co. with the Industrial Union of Marine and Shipbuilding Workers of America, CIO grants pay raises to 78,000 Bethlehem shipyard workers which, estimated by the union, may total about $15,000,000 a year. The contract includes maintenance of union membership, a voluntary check-off, paid vacations, seniority rights and grievance and arbitration machinery. The union has agreed to a strict prohibition of strikes and lockouts. Wages of $1.20 per hours for mechanics and 80½c. minimum for unskilled workers were among the provisions of the new agreement.

•

Aluminum Strike Threat Ended

Pittsburgh

• • • **Representatives** of the Aluminum Workers of America CIO agreed Sept. 18 to abide by the decision of the WLB refusing them a wage increase based on the "Little Steel" formula. The agreement reached here in a meeting with officials of the Aluminum Co. will be sent to local unions for ratification. Thus ends a strike threat which has hung over America's war production for a number of weeks.

Ending the strike threat has opened the way for further union negotiations with the company in an effort to straighten out certain wage inequalities claimed between the southern and northern plants of Alcoa. The WLB's decision which was based on the fact that

If you want MORE PRODUCTION on these operations use APEX

drilling

Quick Change Drill Chucks and Positive Drill Chucks with collets and accessory tools for Drilling, Tapping, Stud Setting and Nut Running. Six sizes from #0 to #6 Morse Taper.

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Safety Friction Tapping Chucks in four sizes to 3" capacity—for Tapping Thru or Bottom Holes, Reaming, Stud Setting, Nut Setting, Spot Facing and Counter Boring—whenever tools are apt to break. You can drive tools to capacity with minimum likelihood of tool breakage.

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Floating Tool Holders—Parallel Float only and Universal with both Parallel and Angular Float. Six types in many different sizes for Reaming and Tapping operations. Our patented ball drive automatically compensates for machine spindle misalignment. These Floating Holders modernize your old machine tools and greatly increase production on new ones.

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A full line of Power Driven Stud Setters with Morse Taper Shanks, Hexagon Shanks, 3/8", 1/2", 3/4" and 1" Square Drives—Shanks to fit Quick Change Drill Chucks and Safety Friction Tapping Chucks. Capacity up to 2 1/2". Hand Stud Setters are furnished with T Handles and combination T Handle with 3/8", 1/2" or 3/4" Square Drives.

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Nut Setters—Universal Joint Type or Plain Type. Universal Joint Type permits the setting of nuts or screws in hard-to-get-at places. Furnished with Morse Taper, Hexagon, Round or 3/8", 1/2", or 3/4" Square Drives. Plain Nut Setters furnished with same type of Shanks.

screw driving

A complete line of Power Bits and Hand Tools for Phillips Recessed Head and Clutch Head Screws, and Power Bits for Slotted Head Screws to fit all makes of Electric, Air and Spiral Drivers.

Write for Catalogs for full information.

THE APEX MACHINE & TOOL COMPANY, DAYTON, OHIO

Alcoa workers en masse had received at least 15 per cent increase since Jan 1, 1941, proved to be a bone of contention to the union who had threatened to strike unless northern worker's wages were increased on a penny for penny scale.

•

C-I Strikers Not Discharged

Gary

• • • **Forty Carnegie - Illinois** cranemen, hookers and loaders who were suspended last week for participation in what was termed a "wildcat" strike will not be discharged it was learned from an unidentified company spokesman this week. Instead the men will be suspended for one week.

•

Army Ousts Two CIO Leaders

Detroit

• • • **Two CIO shop committeemen,** accused of encouraging a recent strike at the Buick Motor Co. aluminum foundry here, were permanently suspended Sept. 23 by the Army.

Lt. Col. G. E. Strong of the Army Air Force central procurement office, who took the action, said that after a month long investigation of the slow-down and strike, evidence indicated that Edmund Geiger and Marion Butler, as union committeemen and leaders, were largely responsible. The strike, which was a one day affair occurring on Aug. 29, was described as having resulted in the loss of vital parts for about 4000 Army bomber engines.

•

WLB Refusal to Mediate Ends Strike

Flint, Mich.

• • • **Work on war** contracts was resumed by 300 employees of Marvel-Schebler Carburetor Division of Borg-Warner Corp. last week, following a declaration by the War Labor Board that it would refuse to mediate the dispute while the strike continued. The walk-out was called by the UAW-AFL after the management, acting on an order from the National Labor Relations Board, reinstated a woman employee who had been discharged in March, 1940, because of non-membership in the UAW-AFL.

•

Kaiser Launches Ship Ten Days after Start

Portland, Ore.

• • • **That man Kaiser** is in the news again with a launching just ten days after the keel was laid. Henry Kaiser's Oregon Shipbuilding Co. set this record with the launching of the 10,500 ton Joseph T. Neal on Sept. 23. The ship is claimed to be 87 per cent complete and was said to have had steam

See picture on page 130.

up when launched. This is a world's record for launching and if the ship is also completed on schedule it will break every shipbuilding record known. Mr. Kaiser never built a ship until last Sept. 27. The best record of World War I was 212 days.

•

Canadian Industry Now Gets Manpower Priority Ratings

Ottawa

• • • **Government officials** say that labor priorities, which in future will govern the flow of available manpower in Canada, now are in

use at employment offices in main industrial centers, under the direction of National Selective Service. Eventually the needs recorded in the new priority lists will determine curtailment of least essential industries. The lists, which will be in constant flux, are based primarily on needs within a locality, but they also will provide for labor requirements which cannot be met in the area where the plants are located. Basic lists have been provided where needs are the most acute. Four groups are specified; very essential, essential, less essential and non-essential.

The priority plan is expected to work something like the following: The Department of Munitions and Supply will notify Selective Service that a certain company has received a contract for tanks. The company will report its labor requirements and also name sub-contractors who will inform Selective Service officers of their needs. Thus in perhaps fifteen or twenty localities, certain firms and occupations with insufficient labor to meet the contract requirements will move up on the priority lists. In some cases the need will be immediate; in others it may be felt in two weeks or a month. As contracts are filled, the plants will lose their priorities.

Employers are required under the nation's manpower regulations to keep Selective Service, also, informed of their labor requirements. This data also will enter into the shifting pattern of the lists. Priority lists for some important centers may change frequently, perhaps every few hours, as the relative importance of work changes. The lists are highly confidential. It is considered conceivable that conditions may arise which place civilian essential needs high in the scale. Shortage of a certain foodstuff, for example, would give a high rating for workers who could assist in its production.

Elliott M. Little, director of National Selective Service, says that the nation will see "a progressive planned pruning of industries not necessary to the minimum standard of life."

•

WLB Votes Closed Shop For First Time

Washington

• • • **The WLB, for the first time,** has gone against the President's declaration of last fall that the government would not order a closed shop, by ordering a closed shop in the case of the Wilson-Jones Co., stationers, of Chicago and Elizabeth, N. J. As the case occurred, the company's contract with the United Paper, Novelty and Toy Workers International Union CIO had expired and the company continued to operate in the face of a strike, maintaining an open shop and not requiring union membership, according to reports. The union argued that once having had a closed shop in the plants that it was entitled to it again when the company signed a new contract. The WLB panel voted in favor of the closed shop rather than maintenance of membership, the device the WLB has been using to settle disputes over union security.

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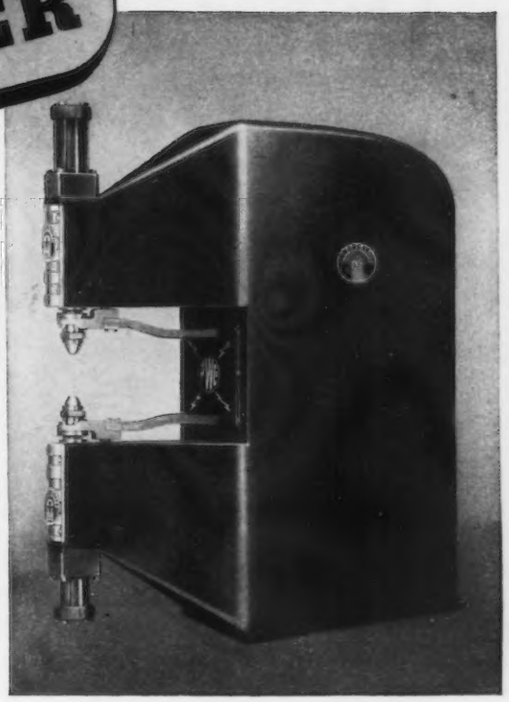

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DESIGNED FOR:

1. Resistance welding of heavy sections, and of
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HOW IT DOES IT:

1. Temperature AT the weld itself controls weld and heat-treat cycles—*automatically.*
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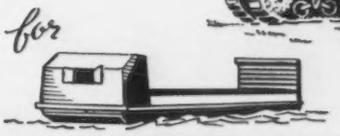

Information on the new process will be furnished at present only to organizations engaged in or contracted to engage in war production work. Please address all inquiries direct to:

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Batcheller Starts WPB Reorganization

Washington

• • • **Hiland G. Batcheller,** new WPB Iron and Steel Branch chief, on Tuesday began reorganization of the branch. Jesse Honeycutt was appointed as acting chief of the Production Section. Other appointments soon will be announced. The CIO has suggested the name of Walter Ruttenberg as deputy chief of the Branch. Mr. Ruttenberg is the CIO's steel workers' research director. Mr. Honeycutt has been an executive consultant of the Iron and Steel Branch and is vice-president of the Bethlehem Steel Co.

•

Mr. Batcheller, a graduate of Wesleyan University, Middletown, Conn., and a trustee of Rensselaer Polytechnic Institute, served in 1941 as a consultant of OPM's priorities division.

WPB Sets Up 5 Priority Ratings on Transportation

Washington

• • • **WPB Chairman** Donald M. Nelson last Thursday issued a certification of necessity to the ODT calling for the setting up of priority regulations to govern the shipment of materials and commodities by tank cars, as follows:

A rating—for transportation of any material for the Army, Navy, Maritime Commission, War Shipping Administration or for Lend-Lease shipment.

B rating—for shipment of commodities included in a WPB list of approximately 390 chemicals, foods, fats and oils, and miscellaneous products.

C rating—for the transportation of petroleum and petroleum products into district 1 and Oregon and Washington.

D rating — for shipment of petroleum and petroleum products, other than automotive gasoline, within district 1 and into or within districts 2, 3, 4 and 5, except Oregon and Washington.

E rating—for the transportation of automotive gasoline within district 1 and into or within districts 2, 3, 4 and 5.

WMC May Freeze Airframe, Tool and Die Employees

• • • **The tool and die** industry in the Detroit area and the airframe industry on the West Coast are called "tender spots" calling for action, by Fowler V. Harper, deputy chairman of the War Manpower Commission. He spoke on Tuesday at an American Management Association conference in New York. Presumably such action to freeze employees would be similar to that taken by the Commission in the non-ferrous mining and smelting industry. All government buying agencies have instructed their contractors to refuse employment to any persons leaving the non-ferrous metal mines unless he has a certificate of separation granted by the U. S. Employment Service.

"From reports received to date," Mr. Harper said, "the plan is working as well or better than anticipated. The chairman and staff of the Commission regard this experiment as of great importance. Presumably it will set the pattern for meeting similar problems elsewhere and similar problems there are." He then characterized the tool and die and the airframe employment problems as the most urgent, and mentioned as an instance one West Coast aircraft company which, "though it has hired thousands of workers in the last 60 days, has had a net drop in employment."

Gear Makers to Meet At Skytop, Oct. 15-17

• • • **Technical committee meetings** relating to various phases of gear production and design problems will take up much of the time of the 25th semi-annual meeting of the American Gear Manufacturers Association, to be held at Skytop, Pa., Oct. 15 to 17. A report will also be presented on the re-rating of speed reducers and gearmotors as a war measure. The meeting will be opened by an address by John H. Flagg, president of the association and general manager of Watson-Flagg Machine Co.

Technical papers to be presented at this meeting include one on "Substitution of Materials," by E. J. Wellauer, supervisor of research, Falk Corp.; another on "Production of Gearing for the Aircraft Industry," by P. W. Brown, assistant works manager, Wright Aeronautical Corp., and a paper on "Production Methods Best Suited to War Needs," by a member of the firm of Stephenson, Jordan & Harrison.

In sessions devoted to commercial subjects, problems raised by "PRP", re-negotiation of contracts, limitation and conservation orders, and OPA orders will be discussed. W. L. Schneider, of the Falk Corp., is general chairman of the commercial committee.

WPB Seizes Illinois Terminal Co.

• • • **It is estimated** that about 35,000 tons of old iron and steel was recovered by WPB through seizure last week of the Illinois Terminal Co., in Illinois. The government took over all of the property of the Terminal Co., except rolling stocks, shops and shop equipment, and about 27 miles of trackage. The yield of scrap was largely from rails, bridges and obsolete machinery. The trackage taken was 128.19 miles. Rails that were in good order will be used by the Army and Navy for relaying and rerolling.

The seizure was made by the Metals Reserve Co., on behalf of the WPB Materials Redistribution Branch, formerly the inventory and requisitioning branch for the Army and Navy.

Grandma Beats Mayor Opens Key Scrap Drive

Buffalo

• • • Mayor Joseph J. Kelly, scrap drive officials and spectators were on hand the other day when the mayor was scheduled to drop the first key into a Victory key box in a central downtown location. Newspaper photographers were poised for the shot and the mayor was about to take his place at the box as a bent old lady, unmindful of the ceremony that was scheduled, slowly shuffled up to the box. Opening a paper bag she carried under her arm the white-haired patriot took one or two keys at a time and deposited them in the box. Her bag emptied, she turned slowly around and made her way again through the throng. The mayor smiled and the drive for old keys was "officially" begun.

Pig Inventories Too Small; Allocations Must Increase

Philadelphia

• • • **One pig iron dealer** said laughingly that they should do all of their business on the first of the month. The reason—every customer requested shipment of the next month's allocation on the first of the month because their inventories were so small that they could not operate for even one week over if the new deliveries did not arrive.

In some cases this loss of production alone is important. However, the really serious consequences is that every time one of these plants shut down they lose skilled help to plants where work is more consistent with the result that many foundries are begging for labor even though wages are high. All that is needed to correct this situation according to the dealers is for pig iron allocations to be increased for a month or an increase spread over several months to allow these foundries to build up an inventory sufficient to assure two weeks of operation without receipt of the next month's quota.

Reports show that this month's allocations of pig iron were slightly better than last month although only about 60 per cent of the quotas asked for were allocated. It may be that more generous allocations are due in the near future.

Restrictions to Halve Structural Steel Output, Convention Told

• • • **Restrictions on** the use of steel for other than war purposes threaten to close down about half of the fabricating structural steel capacity of the United States during the coming year, according to a report by Clyde G. Conley, president of the American Institute of Steel Construction, presented at the opening of the Institute's twentieth annual convention on Tuesday, at Colorado Springs, Colo. "Many of the steel plants have already shifted over to production of special products required by the Army and Navy," he said, adding that new materials and methods have been developed which will not withdraw at the end of the war and leave the markets to the older industries which formerly dominated them.

Thursday's convention program included talks by John C. Page, commissioner of the U. S. Bureau of Reclamation; Walter R. MacCornack, chairman of the A.I.A. committee on post war planning; G. Donald Kennedy, commissioner of the Michigan state highway department; and Ralph L. Carr, governor of Colorado. Friday will be devoted to business meetings and statistical reports, except for a talk on "Renegotiation of Contracts."

•

Another Guide to Priorities Ready Soon

• • • A new Priorities Guide being prepared by THE IRON AGE is scheduled to appear in the Oct. 8 issue. It will include new material and revisions. The last Guide was issued June 4. The new Guide will be the seventh in a series.

Since the demand always exceeds the supply, advance orders for copies of the Guide are now being taken. The price schedule follows:

1 to 10 copies.....50c. each
11 to 100 copies.....40c. each
101 to 300 copies.....35c. each
300 or more copies.....30c. each

Stamps or coin with orders for $2 or less would lighten our load.

46 Production Records Broken by AS&W Plants

Cleveland

• • • **Forty-six record** breaking production performances, bringing the total of production records established since Pearl Harbor to 569, were established during August by plants of the American Steel & Wire Co., a U. S. Steel Corp. subsidiary.

The Worcester, Mass., and Joliet, Ill., operations of the company each contributed nine new records, while the Donora, Pa., Steel & Wire set five new highs. Cuyahoga Works in Cleveland, and the New Haven, Conn., and Trenton, N. J., plants each broke four previous records, while the American Works, Cleveland, and the Waukegan, Ill., operations each surpassed former records three times. The Consolidated Works, Cleveland, broke two former records, while Central Furnaces at Cleveland, the Allentown, Pa., and the Duluth, Minn., plants each contributed one new high.

Construction Shows Substantial Drop

New York

• • • **Engineering construction** volume reported for last week totals $147,699,000, a decrease of 28 per cent from the preceding week, and 10 per cent below the total for the corresponding 1941 week. Private work is 9 per cent under a week ago, and 66 per cent lower than a year ago. Public construction declined 29 per cent from last week, and is 1 per cent below last year.

The week's volume, according to Engineering News-Record, brings 1942 construction to $7,632,606,000, an increase of 58 per cent over the total for the 39-week period last year, and already 30 per cent above the $5,868,699,000 reported for the 52 weeks of 1941. Private work, $474,740,000, is 51 per cent below the volume in the period last year, but public construction, $7,157,866,000, is 85 per cent higher as a result of the 131 per cent gain in federal work.

Ammunition Employment Up 6000 Per Cent in Canada

Ottawa

• • • **Production of rifle** and machine gun bullets in Canada is continually being speeded up. At the outbreak of war some 500 workers were employed in one plant, now 30,000 workers in two Government Arsenals and many factories operated by private interests are turning out ammunition for the Bren gun, Sten carbine, Browning machine gun, Lee-Enfield service rifle, and Boys anti-tank gun. More than half the employees are women.

Canada now is turning out more small arms ammunition in one shift than pre-war facilities could have produced in two months. Production is at a rate of nearly a billion and a half rounds a year, or more than 60 rounds a second.

Brigadier D. E. Dewar, Director General of the arsenals and small arms and ammunition branch, said, "The highlight of this year's production is the fact that we are now standing on our own feet in the matter of components. Now we not only have the complex equipment required, but we have our own facilities for making many of the machine tools we once had to bring in."

A new Canadian plant, which has just gone into production of cores for armor-piercing bullets, is one of the largest of its kind on the continent. Construction of this plant, equipped with batteries of automatic screw machines, now enables Canadian production of cores which once had to be imported. More incendiary and armor-piercing ammunition is coming off Canadian production lines. With production of the Sten carbine to be quadrupled in the course of the next year, 9 mm. ammunition output for this weapon is to be stepped up to millions of rounds a month. The production of .303 ball ammunition is 50 per cent above former objectives; capacity for .55 cal. ammunition has recently come into operation and .50 cal. and 20 mm. ammunition will be coming off the lines soon. Production of .45 cal. ammunition is scheduled for next year.

Scrap There if Hunted, WPB Salvage Man Asserts

Pittsburgh

• • • **If this war is** lost by the United Nations it will be because scrap was not searched out and sped to the nation's steel mills, R. D. McGiffert, Chief, Industry Salvage, WPB, Philadelphia, told members of the Iron and Steel Engineers Association here last week.

"We need 17,000,000 tons of scrap in the next six months," Mr. McGiffert said and added, "already we are 15 per cent behind this quota. At least 4,000,000 tons must come from the farms and homes, 3,000,000 tons from industry and 10,000,000 tons from what is known as active scrap. The latter will be obtained but the real push will be to get the balance."

The speaker said that the only way scrap can be obtained in sufficient quantities from the homes and farms is by a real selling job. This method is also needed for getting old material from industries. Last week it was said the iron and steel industry pledged the help of 2,000 salesmen from the steel companies and 1000 salesmen from the steel warehouses of the country as volunteers to spread the message for the real need of scrap.

As an example of why the selling job is needed, the speaker mentioned that a family at Coatesville, Pa., which had said scrap had all been collected on previous drives, found after a volunteer went around their household with them that they were able to turn up 310 lbs. of scrap they did not know they had.

In another case a farmer had stated that he sold his scrap to a dealer each six weeks and that he had none on his premises. A volunteer went around the farm with him with the result that the farmer who had no scrap turned up 4000 lbs. for the war effort.

"Any piece of machinery that has not been used for three months or will not be used in the next three months should be given to those who can use it or it should be scrapped" is the slogan which should be adopted by industry, McGiffert warned.

Reviewing the various setups in drives, the speaker described the one used at Coatsville and sponsored by the Lukens Steel Co. The county is divided into 11 zones. Each zone has a chairman and each chairman takes the responsibility of getting volunteers. The latter take no more than ten people to work on. These people who are their charges are instructed as to why we need scrap and what can be used. It has been found that in those districts where such a setup exists the return on scrap drives is far above the national average.

Industry is helping out the scrap program by naming high officials to scrap salvage committees. It was found in recent studies that in those locations where industrial salvage manag-

ers were on the job the amount of scrap recovered from plants was several times the amount in the areas where no salvage manager had been named by companies. Likewise home and farm areas served by volunteers are turning in five times as much scrap as those districts without proper organizations.

Warning that the country is 5,000,000 tons of steel behind because of lack of scrap, McGiffert said that the industry would be down 25 to 50 per cent in operations by next February or March unless the drive to recover scrap was a success.

Child Workers

Gen. Hershey Sees Them In War Plants on 3-hr. Day before War Is Won

Cleveland

• • • **"If a man can be taught** in eight months to fly the intricate mechanism that is an army bomber, don't try any longer to tell the draft boards that it takes a year to replace a certain worker," Gen. Hershey said in an address to the war industries here. Plants on war production must think in terms of faster training methods than ever before, and before the war is won children will be compelled to work three or four hours a day to help ease the scarcity of manpower, housewives will have to fit into business and industry at least part time, and the services of even the very old will be required, Mr. Hershey said.

The prospect of a much more careful and rigid selective service machinery was evident from the remarks of General Hershey, both during his talk and during the question and answer session that followed. "A considerable part of the entire male population is going to have to be looked over in the selection of an army of the size we are going to have," he said, and, while the size of that army is a military secret, he said that the size of the army now was 12 times greater than two years ago.

He told industry that it had not made an honest effort to find replacements for employees with occupational and other temporary deferments from the draft, and said that if war industries did not immediately make amends, men would be taken from them as a disciplinary measure even if it meant some sacrifice to production. Questioned if Cleveland, a war industry center, was entitled to more occupational deferments than the national average, General Hershey answered: "Yes. You have a tight labor market here, and when the time comes, your boards will do less shotgun shooting and more with a rifle in deciding occupational deferments."

August Consumption of Scrap

• • • **Consumption of iron** and steel scrap in August is estimated by the Institute of Scrap Iron and Steel, Inc., at 4,645,000 gross tons, which is a slight increase over the 4,600,000 tons for July and 4,518,000 tons for August, 1941.

This Week's Priorities and Prices

• • • **The following data, together with all intermediate weekly revisions in THE IRON AGE, should be added to THE IRON AGE Priorities Guide published with the issue of June 4 to bring the Guide up to date.**

"L" Orders:

L-42...Amendment to Schedule 4 (9-24-42) prohibits use of tar coatings on cast iron soil pipe.

L-64...Amendment (9-24-42) further curtails use of iron and steel in caskets, shipping cases and burial vaults.

L-104...Amendment (9-25-42) curtails production of metal bob and hairpins.

L-114...Interpretation No. 1 (9-25-42) clarifies the kinds of measuring and indicating instruments which are subject to its terms.

L-148...Amended order allows deliveries 90 per cent or more completed by Sept. 8 (9-26-42).

Priority Regulations:

No. 13...Amended (9-23-42) to exclude any material rationed at retail levels, to include intra-company transfers of material in specified circumstances.

Revisions to The Iron Age Priorities Guide

Production Requirements Plan certificates for the fourth quarter of 1942 will be returned to applicants beginning the latter part of the week of Sept. 21. (WPB-1893)

Iron and Steel Producers will be permitted to accept deliveries of maintenance, repair and operating supplies in excess of the amounts authorized under the PRP when necessary for essential operations. (WPB-1900)

High preference ratings for critical materials to meet emergency situations where a small quantity of materials is needed to continue production may be granted by WPB Regional Directors. (WPB-1890)

■ ■ ■

For copies of above announcements address Office of War Information, Washington, giving announcement number as shown in parentheses after each paragraph. (For example, WPB-600 *means announcement* 600 *issued by the War Production Board.)*

Priorities

(CONTINUED FROM PAGE 178)

be accented in the survey and is accompanied by a printed sheet of instructions which show the classification of purchased equipment to be entered in Section C of the form.

The classification of construction materials to be entered in Section D of the form sets forth 57 varieties of carbon steel, alloy steel and stainless steel, nonferrous metals, building services and land development equipment, including pipe and fittings and other building materials.

In general, holders of authorizations to construct facilities under the program will be required to show:

Machinery and Equipment — (Section C) Class of machinery or equipment; description of equipment including size, model and capacity; name of manufacturer; number of units; value; required delivery date; for all machine tools and other metal working equipment, power generating and distributing equipment, and other machinery and equipment for the project reported.

Construction materials required for projects including materials for equipment fabricated at site of project and expendible materials which will be wholly consumed at the location of the project— (Section D) Class of material; description and use of materials; unit of measure; total requirements and value thereof; and materials required to complete project, including required delivery date and value thereof.

It is expected that much of Section A, of Form PD-200, which relates to priorities assistance, and Section B, which relates to capacity and shifts of work, will not be required to be filled out.

Lack of Navy Priority Power Reflects in Pig Allocations

Philadelphia

• • • **Private sources** here today told THE IRON AGE that the lack of authority to issue priorities on the part of the Navy has apparently affected the pig iron allocations for October. It was cited that at least two Navy orders requiring pig iron were thrown out entirely for the month of October when end use forms showed that the need was not urgent. It is believed that delivery would have been mandatory even in this case if the Navy were still placing the priority ratings.

WPB to Loosen Inventory Steel

Washington

• • • **Within 10 days** a triumvirate of government authorities, WPB's Material Redistribution Branch, formerly the Inventory and Requisitioning Branch, the Distress Stock Unit of the WPB Iron and Steel Branch, the Steel Recovery Corp., will speed redistribution of a large portion of the 16,000,000 tons of steel in the hands of manufacturers and others. Steel frozen in inventory by WPB limitation and conservation orders, and any steel which constitutes an idle or excessive inventory will be made available to private purchasers, or sold to the government. This makes available 5,000,000 tons to be redistributed. If purchasers refuse to sell the stocks will be requisitioned under the procedure set up by WPB for this purpose.

Carloadings Show Slight Decrease

• • • **Loading of** revenue freight for the week ended September 19, totaled 903,099 cars, the Association of American Railroads announced. This was a decrease below the corresponding week in 1941, or 4870 cars of five tenths of one per cent, but an increase above the same week in 1940, of 89,700 cars or 11.0 per cent.

Loading of revenue freight for the week of September 19 increased 88,214 cars or 10.8 per cent above the preceding week, which included a holiday. Miscellaneous freight loading totaled 421,827 cars, an increase of 42,838 cars above the preceding week and an increase of 22,413 cars above the corresponding week in 1941.

Loading of merchandise less than carload lot freight totaled 88,479 cars, an increase of 9201 cars above the preceding week, but a decrease of 71,745 cars below the corresponding week in 1941.

PERSONALS . . .

• **Howard D. Grant** has been elected president and **Stevens H. Hammond** has been named executive vice-president of Whiting Corp., Harvey, Ill. Mr. Hammond will also serve as chief of the executive staff. He is the son of Gen. Thomas S. Hammond, formerly president of Whiting Corp., now in charge of the Chicago District Ordnance Staff.

• **Bradford C. Colcord,** formerly general superintendent of the National Tube Co.'s National Works at McKeesport, Pa., has been promoted to assistant vice-president —operations, with headquarters at the general offices in Pittsburgh. **Ralph M. Overton,** who has been assistant general superintendent of National Works, has been advanced to general superintendent of the plant, and **O. P. Adams,** heretofore superintendent of maintenance, National Works, has been appointed assistant general superintendent.

• **S. J. Benn** has been appointed chief engineer of Globe Hoist Co., Philadelphia. Mr. Benn previously was employed as mechanical engineer at Brunner Mfg. Co., and previous to that was chief engineer at Merchant & Evans Co., Philadelphia.

• **Charles A. Sadler,** for many years Brown-Wales Co., Boston, representative in its Lewiston, Me., territory, has been appointed manager, succeeding **John G. Fowler** who has joined the armed forces.

• **G. L. Ouellette** has been named general purchasing agent of L. A. Young Spring & Wire Corp., Detroit.

• **Robert B. Leslie,** formerly general manager of the Vischer Products Co., Chicago, has joined the executive staff of Cook Electric Co.

• **John P. Davey,** formerly of Buffalo, has been appointed assistant general manager of the Curtiss-Wright Corporation Airplane Division plant at Columbus, O. Mr. Davey has been assistant director of manufacturing for the company at St. Louis since he left the Buffalo plant in 1940.

HOWARD D. GRANT (above), and STEVENS H. HAMMOND, president and executive vice-president, respectively, Whiting Corp., Harvey, Ill.

• **Fred C. Tanner,** vice-president and formerly manager of sales and engineering, has been advanced to the position of general manager of Federal Products Corp., Providence. Mr. Tanner was at one time development engineer on new inspection, quality control and production at Western Electric Co. in Chicago, and later chief inspector of radio and general manufacturing with the General Electric Co., Bridgeport.

• **Henry A. Roemer,** formerly manager, steel and wire sales, Pittsburgh Steel Co., has been appointed assistant general manager of sales. **N. F. Melville,** who formerly was assistant to Mr. Roemer, becomes manager, steel and wire sales. Mr. Roemer became associated with Pittsburgh Steel in July, 1936, and in September of that year was made manager of their district office in Charlotte, N. C. Prior to his appointment as manager, steel and wire sales, he was manager of the Pittsburgh district office. Before his association with Pittsburgh Steel, Mr. Roemer was with Republic Steel Corp. from November, 1932, to July, 1936, and prior to that time was connected with Continental Steel Co. and Sharon Steel Co. Mr. Melville has been with Pittsburgh Steel since 1927 and prior to his appointment as assistant to Mr. Roemer, was manager of manufacturers wire sales. Before he became associated with Pittsburgh Steel, Mr. Melville was with Columbia Steel Co. from 1921 to 1926 and prior to that time was with Carnegie Steel Co.

• **Henry J. Chanon,** lighting engineer with General Electric's lamp department at Nela Park headquarters in Cleveland, has just been transferred to the company's South Pacific division in Los Angeles. Mr. Chanon, in his new work, will specialize in the design of lighting systems for maximum production and efficiencies in West Coast aircraft industries, in shipbuilding, and wartime motion picture production work.

• **T. C. Baer** has been elected a director of the Keystone Steel & Wire Co., Peoria, Ill. **A. H. Sommer,** superintendent of the steel mills, was elected to fill the unexpired term of one year of the late Charles W. LaPorte.

• **Robert P. Breese,** formerly of the Bendix Products division of Bendix Aviation Corp., has joined the General Bronze Corp., Long Island City, N. Y., as industrial development engineer.

• **H. V. Coes,** vice-president of Ford, Bacon & Davis, Inc., New York, has been elected by a letter ballot of the 16,250 members of the American Society of Mechanical Engineers to be president of the society during 1943.

MACHINE TOOLS

. . . SALES, INQUIRIES AND MARKET NEWS

1942 Machine Tool Output Will Double Last Year's

• • • **The total output** of machine tools during the calendar year 1942 is estimated at 350,000 units, with a value of $1.4 billion, almost double last year's production of $771 million, which represented 194,000 machine tools, according to the Department of Commerce.

Machine tools are not now the bad bottleneck they were a year or even six months ago. One reason given for the change is success in converting existing plants with much of their machinery to war work. Another reason assigned is the increased efficiency of new machine tools, estimated to be about 20 per cent higher than older tools. These factors, added to the record-breaking quantity of new machine tools delivered during the first seven months of the year, have eased many earlier bottlenecks, actual and threatened.

More new tools it is pointed out, can be used to good advantage in replacing less efficient ones, in doing more precise work, in releasing labor and in economizing on materials and time, but not as many production lines are now stopped for lack of tools.

The value of July shipments of 28,300 machine tools was $114,000,000, an increase of 39 per cent since the outbreak of war in December and 96 per cent above July of last year.

•

"E" Emblems Boost Morale

Cincinnati

• • • **Award of "E" emblems** during the past month has been one of the chief topics of conversation among machine tool builders. With a half dozen or more of them already in receipt of joint Army-Navy E's and Navy E's and others still in the offing, it is noted that these have a very salutary effect upon the morale both of management and labor within the industry. Plants where the awards have been made display the award with pride, while the workmen show an equal uplift in spirit through the wearing of the button. On the other hand, in those places where the award has not yet been received, both management and workers are looking forward to the actual receipt of the award.

New business is not at the level it was, but backlogs are still enormous despite cancellations which have come through every month since the March buying splurge. Net orders are about on a par with shipments. Some machines are being quoted for delivery through 1944, but with the pressing need to get out production **now,** expansion of plant facilities continues.

There are now four machine tool building plants in Cincinnati employing women. Other plants will come around to it as the draft boards take more and more men.

•

Fisher Body Builds Horizontal Boring Mill

Detroit

• • • **Fisher Body Division** of General Motors has expanded its machine tool building program to include a newly designed type of horizontal boring mill and a drilling and tapping machine.

The new horizontal mill weighs 55,000 lb. has a 5-in. bar, a 40-in. horizontal traverse and a 60-in. vertical traverse. Uses are primarily in the building of anti-aircraft guns and tanks. Fisher is using such equipment itself and is supplying machines to other tank builders, both in and out of the automotive industry.

Other unspecified projects of smaller scope are also being undertaken by the company in the machine tool field.

NON-FERROUS METALS

. . . MARKET ACTIVITIES AND PRICE TRENDS

Tin Firm Gives Point Of View on Penang Loss

• • • **Early in September** the Consolidated Tin Smelters held a meeting in London. It was no ordinary meeting, for the stockholders were going to hear a report of what happened in January in Penang, in the Straits Settlements. Ernest V. Pearce, chairman and managing director, presented this report on scorched earth: "On instructions of the military authorities the plant and machinery at the works (Eastern Smelting Co., Ltd.) were partially destroyed in order to prevent their use by the enemy. Demolition could not, however, be carried out owing to lack of time and the fact that the works are situated in a built-up area.

"The rapidity with which events happened, coupled with the absence of labor, rendered it impossible to remove the stocks of refined tin and tin-bearing materials. There was consequently no other course open to the local management than to abandon these stocks which by their nature are practically indestructible."

Mr. Pearce then corrected an impression which the stockholders might pardonably have received (and excused). "Fortunately, this company was among those whose managements foresaw the coming storm," he said. What steps did it take? Why, "surplus cash was remitted to this country, well in advance, and this has contributed materially to the present extent of its resources."

Mr. Pearce's storm clouds had another silver lining to replace the tin one that the Japanese got. "We have made a specific claim," he said, "on His Majesty's Colonial Office in respect of the value of the tin stocks which we have lost, while a general claim is in course of preparation respecting our fixed and other floating assets." This is where some of that cash which was added to the country's resources comes in handy.

Also for the gang aft agley records: At a meeting of the International Tin Committee in London, fourth quarter quotas have been set at 105 per cent of the standard tonnages recommended on Dec. 1. These recommended standards are:

	Tons
Malaya	95,474
Netherlands East Indies	55,113
Bolivia	46,768
Belgian Congo	20,178
Thailand	18,500
Nigeria	15,367

Belgian Congo, Bolivia and Nigeria are, of course, the only sources remaining free to ship to the United Nations.

The aluminum scrap supply has become more plentiful in the past month or so, because much of the aluminum for banned products is moving back for resmelting, and the aluminum fabricating industry is now in full swing. Yards are finding it difficult to move material fast enough because of shipping and sorting troubles. ODT has ruled that cars must be loaded to capacity, so many plants producing scrap have had to ship in mixed cars. After careful segregation in the plant, everything possible is done to keep the metal segregated in the cars through use of built-in partitions, baffle boards, etc. In spite of all the precautions, however, there is a great deal of material scrambling.

Other non-ferrous developments: WPB has notified brass and wire mills that, beginning with November deliveries, no copper orders may be filled which bear preference ratings lower than A-1-A. A new zinc smelter is being considered for Colorado...The Presidio mine, 61 year old Texas silver producer, has reached a low grade zone and has closed...U. S. Geological Survey is studying chromite deposits in Wyoming.

SCRAP

. . . MARKET ACTIVITIES AND QUOTATION TRENDS

Public Campaigns Improving Situation

• • • **Public scrap campaigns** are beginning to improve the supply situation at steel mills but stocks are still far short of normal for this time of year and warnings emphasizing the seriousness of the situation can be expected to come out.

In some sections of the nation so much scrap is being found by the public that problems of transporting it, sorting it and cutting it to steel mill sizes will arise soon. Labor shortages in scrap yards may act as a curb on prompt processing of the material.

Meanwhile, the combined efforts of War Materials, Inc., and the work of the WPB salvage division in obtaining abandoned rails and industrial scrap have helped increase the flow of material in the last few weeks.

If the public's confidence is maintained by prompt handling of the scrap it offers and if the lavish publicity drive is main-

Scrap There if Hunted, page 220

tained continuously, steel mills in another month will be in far better shape than appeared possible to even the most optimistic observers a short time ago. Public enthusiasm is at a high pitch, judging from the mounting piles of scrap over the nation, volunteered by citizens who hope to see it thrown at the Axis. Everything from Civil War cannonballs to 1942 auto bumpers is included. The first Winton auto was given at Cleveland. At New York an offer to turn in a 41-mile railroad was topped by plans to scrap 9000 buildings, including a 22-story unused structure.

Cincinnati and Hamilton County estimated their scrap yield at 380 lb. of metal per capita in nine months. At Buffalo the yield was 132 lb. per capita since May. Nebraska's metal drive netted 104 lb. per person in three weeks

The surface has barely been scratched so far, as a train ride in almost any direction will show. Abandoned bridges, old factory buildings and railroad lines can be found in many places. In Massachusetts it is estimated thousands of tons of street car rails are still buried. WPB will requisition New Haven Railroad rails between Northampton and Turner's Falls, Mass., unless removed in 30 days.

•

Cleveland Drive Aims At 25,000 Tons of Metal

Cleveland

• • • **With appointment** of Charles H. Kellstadt, general manager of Sears, Roebuck & Co. in Cleveland, as chairman, plans got under way this week for a two-week county-wide scrap drive, beginning Oct. 5 to collect 25,000 tons of scrap metal from homes and industry. Mayor Lausche said that City Council would be asked to pass emergency legislation authorizing immediate razing of Central Viaduct.

•

Maratta Procurement Director for Scrap

Pittsburgh

• • • **James Maratta** has been made Director of Procurement of War Materials, Inc., a non-profit corporation organized to procure scrap metals for war purposes on behalf of the government.

•

Scrap Piles Shrink

Detroit

• • • **Scrap piles which** have been building up during the summer are now beginning to diminish. Evidently early September saw the peak reached, and since then receipts in local mills have been less than meltings. Inability to accumulate stocks has made all circles here none too optimistic about the winter outlook. Some slight enlargement in turnings is noted. Mills and brokers, alike, are rather disturbed over increases in upgrading and top dressing of scrap cars within the past few weeks, resulting in an increase of car rejects over normal.

Drive Stepped Up For Industrial Scrap

Washington

• • • **The pressing** necessity for collecting and moving to steel plants 17,000,000 tons of iron and steel scrap between July 1 and Dec. 31 of the current year and the widespread campaign that has been instituted to achieve that end were outlined before the National Conference of Business Papers last Friday by Hamilton W. Wright, Chief of the Industrial Salvage Section of WPB's Conservation Section. Mr. Wright said that only this amount or more of old material is necessary to support the monthly consumption rate of 2,250,000 tons and leave as a balance for steel mill yards on Jan. 1 of next year 7,000,000 tons to carry steel production through the winter months.

The Industrial Salvage Section has inaugurated a country-wide effort to collect dormant scrap from all industrial companies in the United States. Dormant scrap was defined by Mr. Wright as "obsolete machinery, tools, equipment, dies, jigs, fixtures, etc., which are incapable of current or future use in the war production effort because they are broken, worn out, unrepairable, dismantled or in need of unavailable parts necessary to practical re-employment."

It was pointed out that naturally, it is industry which consumes the greatest part of raw materials and therefore produces the greatest quantity of secondary or scrap materials. The Industrial Salvage Section, Mr. Wright said, is working through a field organization of 140 individuals supplemented by approximately 2000 volunteer assistants provided by steel companies, the American Steel Warehouse Association and the National Federation of Sales Executives. With this manpower, the Salvage Section is calling on over 70,000 industrial companies between Oct. 1 and Dec. 31. Through letters to the presidents of these concerns management is being asked to thoroughly inspect their

plant properties with a view toward listing all dormant scrap items and making disposition against this list by next Dec. 31.

•

Auto Industry Recovers 337,000 Tons in Three Months

• • • **Reports to the Automotive Council for War Production show that the industry's program which became effective June 1 and which is being used as a model in other industries, resulted in the return of upwards of 337,000 tons of metal scrap to the mills during the first three months of the plan's operation. This total is exclusive of the scrap used in furnaces and foundries operated by the automotive plants themselves.**

•

PITTSBURGH—The scrap flow here is about unchanged, but last week's numerous drives are expected to ease the situation slightly. The unfortunate part of some of the drives is the effect they have had on small junkies who have been out of the picture and have had to find other work. It is admitted that total volume of household scrap would probably not be obtained except by large scale newspaper publicity and donated trucks, etc., but the passing of more junkies is expected to react adversely to the trade in the future. Several mills in the district are running at full tilt with the help of allocations, their scrap piles having disappeared.

•

BUFFALO—Brokers and yard dealers here report a slight improvement in the movement of scrap to the mills, but the amount going into winter reserves is small. A growing labor shortage and demands for higher wages which dealers claim they cannot possibly meet is slowing down sorting operations. The local Office of War Information reveals 66,000 tons of scrap (132 lb. per capita) collected in public drives since May. Special salvage projects now under way are expected to yield an additional 28,000 tons, in addition to 51 miles of abandoned streetcar track.

•

BOSTON—With metal working plants maintaining a steady flow of turnings, borings, stampings, and supplies of most other kinds of scrap holding up well, shipments to consumers are running ahead of last year, but not all yards have increased their business 33 1/3 per cent. Apparently automobile is the only kind of scrap not increasing in supply. The much publicized Massachusetts scrap drive starts Oct. 5. Yards are being signed up to handle material.

•

BIRMINGHAM—If scrap inventories in this steel-producing area are not increased, and if additional Southern scrap is not made available for Northern mills during the winter months, it will not be through lack of scrap drives in Alabama. The newspaper-sponsored drive is now under way here, and school children of the state will take the field Oct. 5 to search for suitable scrap material. Teachers in most, if not all, public schools in Alabama have received a 20-page manual outlining plans. The school children drive will tie in with the newspaper-sponsored campaign.

•

CINCINNATI—With both the public and industry generally taking the salvage drives more seriously, dealers indicate a modestly better flow of old materials into the yards. Some plants that were holding old equipment and supplies that would be usable in the post-war period are turning these into scrap. Yards generally are now faced with a serious problem in obtaining adequate labor to prepare scrap as rapidly as it is coming in.

•

DETROIT—Removal of an estimated 2000 tons of iron and steel scrap from the closed National Smelting & Refining Co. has begun after two months of delay. Luria Bros. & Co. had successfully bid to remove the metal of the company, which is in receivership, but since that time the owners of the firm had disagreed as to what constituted scrap. Arbitrators finally settled the dispute.

•

PHILADELPHIA — Some slight improvement is reflected this week in the movement of scrap in this area although steel producers are still little better than in a position to operate. Recent salvage drives in the area have turned up some additional scrap which is flowing to the mills now and the most recent drive in the city of Philadelphia has produced what is estimated at about 7000 tons which will also move to the mills during the next few weeks. One producer here who is about to exploit their cinder dump expect it to produce enough scrap to tide them over the winter. Other producers seem to only wait and wonder.

•

ST. LOUIS—The whole scrap picture looks better. Yards are receiving more material as a result of the campaign. Railroads are selling more; increases in receipts up to 50 per cent being reported by yards. First formal lists in more than a month being issued. Industrial scrap is also increasing in volume. Deliveries are being held up because of a shortage of transportation but this is being remedied. A total of 150,000 school children here have entered the campaign for scrap.

•

CHICAGO — Flow of scrap to mills here continues to follow a very erratic course with situation at various mills changing from day to day. Results of newspaper activity are beginning to be felt in volume of light scrap moving; farm scrap flow is also showing slightly better movement as harvesting season ends. No furnaces are reported down here due to lack of scrap. However, deep concern is still felt over winter operations. One district consumer estimates that its scrap pile is about 100,000 tons below normal winter inventory needs.

IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

(All Prices Are Per Gross Ton)

	BASIC OPEN HEARTH GRADES (No. 1 Heavy Melting; No. 1 Hydr. Compressed Black Sheets; No. 2 Heavy Melting; Dealers' No. 1 Bundles; Dealers' No. 2 Bundles; No. 1 Busheling)	Machine Shop Turnings	BLAST FURNACE GRADES (Mixed Borings and Turnings; Shovelling Turnings; No. 2 Busheling; Cast Iron Borings)	ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES										
				Low Phos.		Heavy Structural and Plate			Cut Auto. Steel Scrap					
				Billet, Bloom, Forge Crops	Bar Crops, Punchings Plate Scrap and Cast Steel	3 ft. and Under	2 ft. and Under	1 ft. and Under	3 ft. and Under	2 ft. and Under	1 ft. and Under and Auto, Springs, and Crankshafts	Alloy free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	$20.00	$16.00	$16.00	$25.00	$22.50	$21.00	$21.50	$22.00	$20.00	$20.50	$21.00	$18.00	$19.50	$21.00
Cleveland, Middletown, Cincinnati, Portsmouth	19.50	15.50	15.50	24.50	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Pt.	18.75	14.75	14.75	23.75	21.25	19.75	20.25	20.75	18.75	19.25	19.75	16.75	18.25	19.75
Ashland, Ky.	19.50	15.50	15.50	24.50	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50
Buffalo, N. Y.	19.25	15.25	15.25	24.25	21.75	20.25	20.75	21.25	19.25	19.75	20.25	17.25	18.75	20.25
Bethlehem, Pa.; Kokomo, Ind.	18.25	14.25	14.25	23.25	20.75	19.25	19.75	20.25	18.25	18.75	19.25	16.25	17.75	19.25
Duluth, Minn.	18.00	14.00	14.00	23.00	20.50	19.00	19.50	20.00	18.00	18.50	19.00	16.00	17.50	19.00
Detroit, Mich.	17.85	13.85	13.85	22.85	20.35	18.85	19.85	19.85	17.85	18.35	18.85	15.85	17.35	18.85
Toledo, Ohio	.....	13.85	13.85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.	17.50	13.50	13.50	22.50	20.00	18.50	19.00	19.50	17.50	18.00	18.50	15.50	17.00	18.50
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles; Pittsburg, Cal.; San Francisco	17.00	13.00	13.00	22.00	19.50	18.00	18.50	19.00	17.00	17.50	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	12.50	12.50	21.50	19.00	17.50	18.00	18.50	16.50	17.00	17.50	14.50	16.00	17.50
Seattle, Wash.	14.50	10.50	10.50	19.50	17.00	15.50	16.00	16.50	14.50	15.00	15.50	12.50	14.00	15.50

BUNDLES: Tin can bundles are $4 below dealers' No. 2 bundles; No. 3 bundles are $2 less than No. 1 heavy melting.

SWITCHING CHARGES: Deductions for shipping points within basing points (cents per gross ton) are: Pittsburgh, Brackenridge, 55c.; Midland, Johnstown, Sharon, Youngstown, Warren, Weirton, Cleveland, Toledo, Los Angeles, San Francisco, 42c.; Butler, Monessen, Canton, Steubenville, Cincinnati*, Portsmouth, Ashland, Coatesville, Harrisburg, Phoenixville, Bethlehem, Kokomo, Duluth, St. Louis, 28c.; Buffalo, Claymont, 36c.; Conshohoken, 11c.; Atlanta, Birmingham, 32c.; Pittsburg, Cal., 42c.; Middletown, 14c.; Sparrow's Point, 11c.; Chicago, 84c.; Detroit, 53c.; Alabama City, 26c.; Minnequa, 22c.; Seattle, 38c.. *At Cincinnati, for basic open hearth grades, cut auto scrap and auto springs and crankshafts, deduct 80c. per ton.

PITTSBURGH basing point includes switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport. Cincinnati basing point includes Newport, Ky., switching district. St. Louis includes switching districts of Granite City, East St. Louis, Madison, Ill. San Francisco includes switching districts of S. San Francisco, Niles and Oakland, Cal.

MAXIMUM prices of inferior grades shall continue to bear same differential below corresponding grades as existed during the period Sept. 1, 1940, to Jan. 31, 1941. Superior grades cannot be sold at a premium without approval of OPA. Special preparation charges in excess of the above prices are banned. Whenever any electric furnace or foundry grades are purchased for open hearth or blast furnace use, prices may not exceed the prices above for the corresponding open hearth grades.

MAXIMUM SHIPPING POINT PRICE—Where shipment is by rail or vessel, or by combination of rail and vessel, the scrap is at its shipping point when placed f.o.b. railroad car or f.a.s. vessel. In such cases, the maximum shipping point prices shall be: (a) For shipping points located within a basing point, the price listed in the table above for the scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point and (b) for shipping points located outside the basing point, the price in table above at the most favorable basing point minus the lowest transportation charge by rail or water or combination thereof. Dock charge is 75c. a ton*, but 50c. if moved by deck scow or railroad lighter. Shipping by motor vehicle: The scrap is at its shipping point when loaded. For shipping points located within basing points take price listed in table minus applicable switching charge. If located outside a basing point, the price at the most favorable basing point minus lowest established charge for transporting by common carrier. If no established transportation rate exists, the customary costs are deducted. Published dock charges prevail. If unpublished include 75c.* For exceptions see official order.

AT NEW YORK city or Brooklyn, the maximum shipping point price is $15.33 for No. 1 heavy melting, f.o.b. cars, f.a.s. vessel or loaded on truck. Other grades carry differentials similar to those in table. New Jersey prices must be computed on basis of all-rail. At Boston the maximum is $15.05 for No. 1 f.o.b. cars, f.a.s. vessel or loaded on trucks. Shipments from a New England shipping point to a consumer outside New England carry maximum transportation charge of $6.65 per ton.

UNPREPARED SCRAP: For unprepared scrap, maximum prices shall be $2.50 (and in the case of the material from which No. 1, No. 2, and No. 3 bundles are made $4) less the maximum prices for the corresponding grade or grades of prepared scrap. In no case, however, shall electric furnace and foundry grades be used as the "corresponding grade or grades of prepared scrap." Converter may charge $2.50 per ton on consumer-owned unprepared remote scrap (see order).

Maximum price of all scrap in a vehicle is that of the lowest price grade in the shipment. This limitation does not apply to vessel shipments if grades are segregated.

Where scrap is to undergo preparation prior to its arrival at the point of delivery, such scrap is not at its shipping point, as that phrase is defined above, until after preparation has been completed.

CHEMICAL BORINGS: No. 1 (new, clean, containing not more than 1 per cent oil), $1 less than No. 1 heavy melting; No. 2 (new, clean, containing not more than 1.5 per cent oil), $2 less than No. 1 heavy melting. If loaded in box cars add 75c.

UNPREPARED CAST IRON SCRAP—Except for heavy breakable cast, unprepared scrap is given a price ceiling of $2.50 per ton less than the maximum prices for the corresponding grade of prepared cast iron scrap. Where scrap is to undergo preparation prior to arrival at the point of delivery, such scrap is not considered at shipping point until preparation is completed.

Consumers of cast scrap may pay the shipping point price plus established charge for transporting the scrap to their plants. In the case of deliveries by truck, the cast scrap buyer must obtain from the seller a certification, made out to OPA.

*At Memphis 50c.; Great Lakes ports $1; New England $1.25.

RAILROAD SCRAP

	No. 1 RR Heavy Melting	Scrap Rails	Rails for Rerolling	Scrap Rails 3 ft. and Under	Scrap Rails 2 ft. and Under	Scrap Rails 18 in. and Under
Cleveland, Cincinnati, Ashland, Portsmouth, Middletown	$20.50	$21.50	$23.00	$23.50	$23.75	$24.00
Canton, Pittsburgh, Sharon, Steubenville, Wheeling, Youngstown	21.00	22.00	23.50	24.00	24.25	24.50
Chicago, Philadelphia, Sparrows Pt., Wilmington, Birmingham, Los Angeles, San Francisco	19.75	20.75	22.25	22.75	23.00	23.25
Buffalo	18.00	19.00	20.50	21.00	21.25	21.50
Detroit	18.85	19.85	21.35	21.85	22.10	22.35
Duluth	19.00	20.00	21.50	22.00	22.25	22.50
Kansas City, Mo.	17.00	18.00	19.50	20.00	20.25	20.50
Kokomo, Ind.	19.25	20.25	21.75	22.25	22.50	22.75
Seattle	15.50	16.50	18.00	18.50	18.75	19.00
St. Louis	18.50	19.50	21.00	21.50	21.75	22.00

CAST IRON SCRAP

	Group A	Group B	Group C
No. 1 cupola cast	$18.00	$19.00	$20.00
No. 1 machinery cast, drop broken, 150 lbs. and under	18.00	19.00	20.00
Clean auto cast	18.00	19.00	20.00
Unstripped motor blocks	17.50	18.50	19.50
Stove Plate	17.00	18.00	19.00
Heavy Breakable Cast	15.50	16.50	17.50
Charging box size cast	17.00	18.00	19.00
Misc. Malleable	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico.

Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas Oklahoma, Texas and Florida.

Group C: States not named in A and B; switch district of Kansas City, Kan., Mo.

. . . Composite Prices

Advances Over Past Week in **Heavy Type**; Declines in *Italics*. (Prices Are F.O.B. Major Basing Points)

Flat Rolled Steel: (Cents Per Lb.)	Sept. 29, 1942	Sept. 22, 1942	Sept. 1, 1942	Sept. 30, 1941
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

Pig Iron: (Per Gross Ton)	Sept. 29, 1942	Sept. 22, 1942	Sept. 1, 1942	Sept. 30, 1941
No. 2 fdy., Philadelphia	$25.89	$25.89	$25.89	$25.84
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	24.68	24.68	24.68	24.06
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.39	25.39	25.39	25.34
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	31.34	31.34	31.34	31.34
Ferromanganese‡	135.00	135.00	135.00	120.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melting steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	23.00
No. 1 cast, Pittsburgh	20.00	20.00	20.00	22.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	24.00
No. 1 cast, Ch'go	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$6.00	$6.00	$6.00	$6.125
Foundry coke, prompt	6.875	6.875	6.875	6.875
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	7.25
Lead, St. Louis	6.35	6.35	6.35	5.70
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

. . . Comparison of Prices

FINISHED STEEL	PIG IRON	SCRAP STEEL
Sept. 29, 1942 ..... 2.30467c., a Lb.	..... 23.61 a Gross Ton	..... $19.17 a Gross Ton
One week ago ..... 2.30467c. a Lb.	..... 23.61 a Gross Ton	..... $19.17 a Gross Ton
One month ago ..... 2.30467c. a Lb.	..... 23.61 a Gross Ton	..... $19.17 a Gross Ton
One year ago ..... 2.30467c. a Lb.	..... 23.61 a Gross Ton	..... $19.17 a Gross Ton

	HIGH	LOW	HIGH	LOW	HIGH	LOW
	2.30467c.,	2.30467c.,	$23.61	$23.61	$19.17	$19.17
1942	2.30467c.,	2.30467c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1941	2.30467c.,	2.30467c.,	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1939	2.35367c., Jan. 3	2.26689c., May 16	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.92, Nov. 10
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1933	1.95578c., Oct. 3	1.75836c., May 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1932	1.89196c., July 5	1.83901c., Mar. 1	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1931	1.99629c., Jan. 13	1.86586c., Dec. 29	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1929	2.31773c., May 28	2.26498c., Oct. 29				

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Heat Treating Terms

(CONTINUED FROM PAGE 103)

composition, followed by either quenching, or cooling slowly as required.

Carburizing.* — A process in which carbon is introduced into a solid iron-base alloy by heating above the transformation temperature range while in contact with a carbonaceous material which may be a solid, liquid, or gas. Carburizing is frequently followed by quenching to produce a hardened case.

** The term* Carbonizing *is sometimes used erroneously in place of* Carburizing.

Case.—The surface layer of an iron-base alloy which has been suitably altered in composition and made substantially harder than the interior or core by a process of case hardening.

Casehardening.—A process of surface hardening involving a change in the composition of the outer layer of an iron-base alloy followed by appropriate thermal treatment. Typical casehardening processes are **Carburizing, Cyaniding, Carbonitriding,** and **Nitriding.**

Cementation.—(Obsolete).

Controlled Cooling.—A term used to describe a process by which a steel object is cooled from the final hot forming operation in a predetermined pattern of cooling.

Core.—The interior portion of an iron-base alloy which after casehardening is substantially softer than the surface layer or case.

Critical Range or **Critical Temperature Range.** — Synonymous with **Transformation Range,** which is preferred.

Cyaniding.—A process in which an iron-base alloy is heated in contact with a cyanide salt so that the surface absorbs carbon and nitrogen. Cyaniding is usually followed by quenching to produce a hard case.

Decarburization.—The loss of carbon from the surface of an iron-base alloy as the result of heating in a medium which reacts with the carbon.

Differential Heating.—A heating process by which the temperature varies throughout, the object being heated so that on cooling different portions may have such different physical properties as may be desired.

Differential Quenching. — A quenching process by which only certain desired portions of the object are quenched and hardened.

Drawing.—Drawing, or drawing the temper, is synonymous with **Tempering,** which is preferable. (Obsolete.)

Flame Annealing.—A process in which the surface of an iron-base alloy is softened by localized heat applied by the flame of a high-temperature torch.

Flame Hardening.—A process of heating the surface layer of an iron-base alloy above the transformation temperature range by means of the flame of a high-temperature torch, followed by quenching.

Full Annealing.—A softening process in which an iron-base alloy is heated to a temperature above the transformation range and after being held for a proper time at this temperature is cooled slowly to a temperature below the transformation range. The objects are ordinarily allowed to cool slowly in the furnace, although they may be removed from the furnace and cooled in some medium which reduces the rate of cooling.

Graphitizing. — An annealing process applied to certain iron-base alloys, such as gray cast iron or some steels with high carbon and silicon contents, by which the combined carbon is wholly or in part transformed to graphitic or free carbon. (See also **Temper Carbon.)**

Hardening.—Any process of increasing hardness by suitable treatment, usually involving heating and cooling.

Heat Treatment.—A combination of heating and cooling operations applied to a metal or alloy in the solid state to obtain desired conditions or properties. Heating for the sole purpose of hot working is excluded from the meaning of this definition.

Homogenizing.—A high temperature heat-treatment process intended to eliminate or decrease chemical segregation by diffusion.

Hot Quenching.—A process of quenching iron-base alloys in a medium, the temperature of which is substantially higher than atmospheric.

Inverse Annealing.—A heat-treatment, analogous to **Precipitation Hardening,** applied to cast iron to increase its hardness and strength.

Malleablizing.—A process of annealing white cast iron in which the combined carbon is wholly or in part transformed to graphitic or free carbon, and, in some cases, part of the carbon is removed completely. (See also **Temper Carbon.)**

Nitriding.—A process of case-hardening in which an iron-base alloy of special composition is heated in an atmosphere of ammonia or in contact with nitrogenous material. Surface hardening is produced by the absorption of nitrogen without quenching.

Normalizing. — A process in which an iron-base alloy is heated to a temperature above the transformation range and subsequently cooled in still air at room temperature.

Overheated.—A metal is said to have been overheated if, after exposure to an unduly high temperature, it develops an undesirable coarse grain structure but is not permanently damaged. The structure damaged by **Overheating** can be corrected by suitable heat treatment or by mechanical work or by a combination of the two. In this respect it differs from a **Burnt** structure.

Patenting.—A process of heat treatment applied to medium or high carbon steel in wire making between wire drawings. It consists in heating to a temperature above the transformation range, followed by cooling to a temperature below that range in air or in a bath of molten lead or salt maintained at a temperature appropriate to the carbon content of the

steel and the properties required of the finished product.

Pot Quenching.—A process of quenching carburized parts directly from the carburizing box or pot.

Precipitation Hardening.—The process of hardening an alloy by reheating it to allow a structural constituent to precipitate from a solid solution. (See also **Aging.**)

Preheating.—(1) A general term used to describe a heating applied preliminary to some further thermal or mechanical treatment. (2) A term specifically applied to tool steel to describe a process in which the steel is heated slowly and uniformly to a temperature below the hardening temperature and is then transferred to a furnace in which the temperature is substantially above the preheating temperature.

Process Annealing.—A process commonly applied in the sheet and wire industries, in which an iron-base alloy is heated to a temperature close to, but below, the lower limit of the transformation range and subsequently cooled.

Quenching.—A process of rapid cooling from an elevated temperature, by contact with liquids, gases, or solids.

Sandberg Sorbitic Treatment.—A treatment in which carbon steel objects are moderately hardened, either wholly or in part. It consists in cooling the parts to be hardened through the transformation range at a moderately rapid rate by the application of jets of air, steam, or atomized water and then allowing the residual heat in the object to effect a tempering operation.

Secondary Hardening.—An increase in hardness following the normal softening during the tempering of certain alloy steels.

Soaking.—Prolonged heating of a metal at a selected temperature.

Solution Heat Treatment.—A treatment in which an alloy is heated to a suitable temperature and held at this temperature for a sufficient length of time to allow a desired constituent to enter into solid solution, followed by rapid cooling to hold the constituent in solution. The material is left in a state of unstable equilibrium, and if reheated, may undergo **Precipitation Hardening.**

Spheroidizing.—Any process of

heating and cooling steel that produces a rounded or globular form of carbide. Spheroidizing methods frequently used are as follows:

(1) Prolonged heating at a temperature just below the lower limit of the transformation temperature range with subsequent slow cooling.

(2) The object is subjected to a temperature which rises and falls alternately between a point within and a point just below the transformation range. This method gives good results with small high-carbon steel objects.

(3) Tool steel may be spheroidized by heating to a temperature above the transformation range and then, after holding a suitable time, cooling very slowly in the furnace.

(4) Tool steel containing a carbide network may be spheroidized by quenching in oil from the minimum temperature at which all the carbon is dissolved, followed by reheating to a temperature slightly below the transformation range.

Stress Relieving.—A process to reduce internal residual stresses in a metal object by heating the object to a temperature below the transformation range and holding for a proper time at that temperature. This treatment may be applied to relieve stresses induced by casting, quenching, normalizing, machining, cold-working, or welding.

Temper Carbon.—The free or graphitic carbon which comes out of solution usually in the form of rounded nodules during **Graphitizing** or **Malleablizing.**

Tempering.—A process of reheating hardened or normalized steel to a temperature below the transformation temperature range, followed by any desired rate of cooling.

Transformation Range. — The transformation range on heating is the temperature interval in which austenite forms in an iron-carbon alloy. The transformation range on cooling is the temperature interval in which austenite disappears. Distinction must be made between the two ranges. They may overlap but never coincide. The limiting temperatures of the ranges depend on the composition of the alloy and, particularly for the cooling, on the rate of change of temperature.

Exhibitors at the Metal Congress

(CONTINUED FROM PAGE 243)

Machinery, New York City. Booth E-122.

Machinery Mfg. Co., Vernon, Los Angeles, Calif. Booth D-335.

Magnaflux Corp., Chicago. Booth A-320.

Magnetic Analysis Corp., Long Island City, N. Y. Booth D-327.

Mahr Manufacturing Co., Minneapolis, Minn. Booth D-418.

Mall Tool Co., Chicago. Booth D-321.

P. R. Mallory & Co., Inc., Indianapolis, Ind. Booth A-500.

Manhattan Rubber Mfg. Co., Passaic, N. J. Booth D-323.

Marquette Mfg. Co., Minneapolis, Minn. Booth A-315.

Martindale Electric Co., Cleveland. Booth B-114.

Matchless Metal Polish Co., Chicago. Booth E-113.

Mazlo Magnesium. Booth C-421.

McKenna Metals Co., Latrobe, Pa. Booth C-110.

Meehanite Res. Inst. of America, Pittsburgh. Booth B-320.

Metal Finishing. Booth B-526.

Metal Industry Publishing Co., New York. Booth B-526.

Metal Progress.

Metals & Alloys, New York. Booth A-513.

Mill & Factory, Chicago. Booth L-103.

Minnesota Mining & Mfg. Co., St. Paul, Minn. Booth B-340.

Modern Machine Shop, Cincinnati. Booth C-431.

Molybdenum Corp. of America, Pittsburgh. Booth D-111.

Monarch Steel Co. Booth C-315.

Morrison Engineering Co., Cleveland. Booth A-414.

Morse Magneto Clock Co., New York. Booth A-511.

Moss-Chase Co., Buffalo, N. Y. Booth C-428.

Motor Products Co. Booth A-401.

Multi-Hydromatic Welding & Mfg. Co., Detroit. Booth A-500.

National Electric Welding Machine Co., Bay City, Mich. Booth A-500.

National Industrial Publishing Co., Pittsburgh. Booth D-325.

National Machine Works, Chicago. Booth B-130.

National Machinery Co., Tiffin, O. Booth A-335.

National Refining Co., Cleveland. Booth A-420.

Niagara Blower Co., New York. Booth C-428.

Nicholson File Co., Providence, R. I. Booth C-320.

Norton Co., Worcester, Mass. Booth C-138.

Oakite Products, Inc., New York. Booth E-134.

Oficina Mecanica Moderna. Booth C-431.

Ohio Carbon Co., Cleveland. Booth C-328.

Ohio Crankshaft Co., Cleveland. Booth A-324.

Ohio Seamless Tube Co., Shelby, O. Booth D-110.

Osborn Mfg. Co., Cleveland. Booth B-427.

Pangborn Corp., Hagerstown, Md. Booth C-130.

Park Chemical Co., Detroit. Booth S-112.

Parker-Kalon Corp., New York. Booth B-134.

Penton Publishing Co., Cleveland. Booth E-143.

Henry Perkins Co., Bridgewater, Mass. Booth B-320.

Philips Metalix Corp., New York. Booth B-337.

Phillips Manufacturing Co., Chicago. Booth C-327.

Phoenix Machine Co. Booth A-341.

Picker X-Ray Corp., New York. Booth B-122.

Pittsburgh Pipe Cleaner Co., Pittsburgh. Booth A-431.

Pohlman Fdry. Co., Buffalo, N. Y. Booth B-320.

Porter-Cable Machine Co., Syracuse, N. Y. Booth A-519.

Precise Tool & Mfg. Co., Farmington, Mich. Booth A-311.

Product Engineering. Booth E-137.

Products Finishing. Booth C-431.

Progressive Welder Co., Detroit. Booths A-340 and A-500.

Radium Chemical Co., Inc., New York. Booth B-504.

N. Ransohoff, Inc., Cincinnati. Booth B-311.

Ransome Concrete Machinery Co., Dunellen, N. J. Booth B-102.

Reeves Pulley Co., Cleveland. Booth A-419.

Reeves Pulley Co., Columbus, Ind. Booth A-419.

Reinhold Publishing Corp. Booth A-513.

Resistance Welders Mfrs. Assoc., Warren, O. Booth A-500.

Revere Copper & Brass Co., New York. Booth B-306.

Riehle Testing Machine Div., American Machine and Metals, Inc., East Moline, Ill. Booth A-418.

Rolock, Inc., Fairfield, Conn. Booth S-132.

Rosedale Fdry. & Machine Co., Pittsburgh. Booth B-320.

Ross-Meehan Foundries, Chattanooga, Tenn. Booth B-320.

Rustless Iron & Steel Corp., Baltimore, Md. Booth C-102.

Safety Socket Screw Corp., Chicago. Booth C-226.

George Scherr Co., New York. Booth E-110.

A. Schrader's Son, Brooklyn, N. Y. Booth D-410.

Sciaky Bros., Chicago. Booth A-518.

Selas Co., Philadelphia. Booth D-102.

Sentry Co., Foxboro, Mass. Booth B-411.

S-M-S Corporation, Detroit. Booth A-500.

Sparkler Mfg. Co., Mundelein, Ill. Booth A-523.

Spencer Turbine Co., Hartford, Conn. Booth E-141.

Sperry Products, Inc., Hoboken, N. J. Booth A-306.

Standard Oil Company (Ohio), Cleveland. Booth D-336.

Standard X-Ray Machine Co., Chicago. Booth A-429.

Stearns-Rogers Mfg. Co., Denver, Colo. Booth B-320.

Steel. Booth E-143.

Steel Publications. Booth B-514.

Sterling Alloys, Inc., Woburn, Mass. Booth B-115.

D. A. Stuart Oil Co., Ltd., Chicago. Booth C-310.

Surface Combustion, Toledo.

Swift Electric-Welder Co., Detroit. Booth A-500.

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. Booth S-126.

Taylor-Hall Welding Corp., Worcester, Mass. Booth A-500.

Taylor-Winfield Corp., Warren, O. Booth A-500.

Tempil Corp., New York. Booth B-138.

Thomson-Gibb Electric Welding Co., Lynn, Mass. Booth A-500.

Tide Water Associated Oil Co., New York. Booth D-324.

Tinnerman Products, Inc., Cleveland. Booth D-414.

Titanium Alloy Manufacturing Co., Niagara Falls. Booth A-336.

Harold E. Trent Co., Philadelphia. Booth A-405.

Triplex Machine Tool Corp., New York. Booth D-310.

Upton Electric Furnace Div. Booth B-424.

Valley Iron Works, St. Paul, Minn. Booth B-320.

Vanadium Corporation of America, New York. Booth A-510.

Victor Saw Works, Inc., Middletown, N. Y. Booth A-328.

Vulcan Fdry. Co., Oakland, Calif. Booth B-320.

Wall-Colmonoy Corp., Detroit. Booth B-339.

Warren Fdry. & Pipe Corp., Phillipsburg, N. J. Booth B-320.

Welding Engineer, Chicago, Ill. Booth S-158.

Welding Engineer Publishing Co. Booth S-158.

Welding Engineering Co., Milwaukee, Wis.

Welding Machines Mfg. Co., Detroit. Booth A-500.

Welding Sales & Engineering Co., Detroit. Booth A-500.

S. K. Wellman Co., Cleveland. Booth E-142.

Wells Manufacturing Corp., Three Rivers, Mich. Booth B-310.

Westinghouse Electric & Mfg. Co., E. Pittsburgh. Booth B-405.

Wilson Mechanical Instrument Co., Inc,. New York. Booth C-137.

Wire Association, Stamford, Conn. Booth A-425.

Wire and Wire Products. Booth A-425.

How to Win a War

ONLY one grim, pressing need justifies the journey of thousands of technical men to Cleveland the week of Oct. 12 for the twenty-fourth Metal Congress — and that is the utter imperativeness of pooling ideas and information; of considering the other fellow's viewpoint and his problems; of providing full opportunity for the exchange of experiences, and the cross-checking of all progress for the benefit of the war effort as a whole, so as to prove that America's metal industry can win the battle of production which is now entering its crucial stage.

Every activity of this coming Metal Congress has been geared to the war effort. The American Society for Metals, and the cooperating societies —American Institute of Mining and Metallurgical Engineers, Welding Society, and Wire Association — are all conscious of their responsibility to continue to afford that established and accepted common meeting place where the metal men of the nation can convene to discuss their problems and plans and examine new and improved aids to increase production of material.

Conspicuous in the technical plans of all the societies is the war production meetings of the A.S.M. These conferences will be patterned after the successful "defense meetings" at last year's convention, with recognized authorities sitting before microphones, speaking concisely, briefly, informally and off the record on important assigned phases of the topic, and with all speakers acting later as members of an information panel for open discussion.

These group meetings are not to be the ordinary round-table type where everything is left to chance but are to be well planned and conducted meetings. The chairmen have been carefully selected and will be expected to keep the meeting in purely technical and educational channels and away from questions of political policy or advertising. At each meeting where WPB officials are available and able to contribute information and direction to these clinics, they will be invited to participate.

The summarizer will act as secretary of the meetings, noting important points made by each speaker and brought out in discussion and will be allotted ten minutes before the close of the session to high-light the important information presented.

Therefore, the first part of the meeting will hear the presentation of prepared, short, concise material on subdivisions of the main subject, as shown here and also in the correlated technical program, covering a total presentation period of approximately 60 min. The remainder of the sessions will be devoted to an open discussion and question period with the speakers on that particular problem seated on the platform and acting as members of an information panel.

So meetings may be smooth and profitable, speakers will be notified later about luncheon and dinner meetings on the day of their sessions where details of the sessions will be worked out.

These group meetings are off the record. In other words, no stenographic notes will be taken as the speaker talks. No prepared papers. No printed papers.

All A.S.M. technical papers (45) are to be presented in simultaneous sessions at Hotel Statler *in the morning* from Oct. 12 to 16, leaving the afternoons and evenings free for the war production sessions at the Public Auditorium.

The following subjects will be discussed in the War Production Sessions:

"Doing More with What We Have in Increasing Production from Open Hearth Plants"; "Increasing Yields of Electric Furnaces (Electric Steel Manufacture)"; "Problems Associated with the Large Expansion of the Steel Foundry Industry"; "Doing More with What Alloys We Have by Using NE Steels (two sessions)"; "Doing More with Low Alloy and Carbon Steels by Use of Special Additions in Steel Manufacture (Intensifiers)"; "Doing More with Available Tool Steels"; "Speeding the Job by Better Production Heating for Softening (Hot Working and Annealing)"; "Speeding the Job by Better and Faster Production Hardening"; "Manufacture and Heat Treatment of Magnesium Castings"; "Fabrication of Aluminum Sheet"; "Making Better Use of Secondary Metals"; "Segregation, Collection and Reclamation of Scrap"; "On Deep Drawing Problems (two sessions) I. Brass II. Steel"; "Speeding Production by Improved Metal Cutting Practice (two sessions)"; "Interpretation of Magnaflux and Other Surface Inspection Tests"; "Use and Interpretation of Radiographic Inspection"; "Current Achievements in Powder Metallurgy"; "Training and Handling Inspectors"; "Getting By with Low Tin Alloys"; "Salvage of Broken Tools and Maintenance of Equipment"; "Employee Training in Metal Working Departments (Fabrication)"; "Methods and Materials for Surface Protection."

The Iron and Steel and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers will, as usual, hold their annual fall meeting in connection with the National Metal

# of Production . . .

More and More Efficient Output Is Theme of Twenty-Fourth Metal Congress

Congress. Despite the pressure on members of the two Metals Divisions to turn out war material, the technical program (see correlated program herein) gives promise of being of exceptionally high quality.

The feature of the Institute of Metals Division sessions will be an all-day symposium on rare and precious metals. This symposium is being aranged by E. M. Wise, vice-chairman of the Division's Rare and Precious Metals Committee. At least eight short papers will be presented, and plans are on foot for several surprises during this symposium and discussion.

In addition to the symposium there will be a number of interesting and important papers on constitution, especially of aluminum and magnesium-rich alloys, lead-rich alloys and copper-rich alloys.

The Iron and Steel Division program is noteworthy this year for papers on production. There will be one session on the blast furnace and on the raw materials used in the manufacture of pig iron and one on the physical chemistry of steel making.

An interesting investigation on the bleeding of ingots will be reported and there will be at least one paper on hardenability.

From the standpoint of the war effort and of the attempts the iron and steel industry is making to get along with inferior grades of scrap, a very important paper will be presented by J. W. Halley of the Inland Steel Co. entitled, "The Effect of Tin on the Properties of Plain Carbon Steel."

As usual, the joint division dinner will be held on Tuesday evening.

Altogether there will be some 57 papers presented before members of the American Welding Society, covering every phase of welding, by outstanding leaders in the welding industry.

Two papers will be presented dealing with the training of welding foremen and methods of construction for welding operators developed by the U. S. Office of Education.

How do welds behave under dynamic stresses? What happens to metals when they are subjected to combined stresses? What is the relative fatigue strength of welded joints and the base metal? What is the impact strength of high-alloy steels? The answers will be furnished in the session on fatigue and impact.

Two separate sessions will be devoted to the subject of war production. Special papers will deal with applications of flame hardening. The developments in a.c. welding for high quality vertical and overhead welds, the conservation and effective use of equipment and supplies for cutting and welding, new developments in aluminum and bronze welding, automatic arc welding for production work, welded steel tubing and its application in war production, and several others.

Two sessions will be devoted to weldability of steel. For the first time, papers will be presented which will approach the weldability problem in a fundamental way. Specific papers will deal with the effect of cooling rates on the base material and on the welded joints, the development of special weldability tests will be indicated, the effect of carbon and manganese on the weldability of steels will be covered in an especially comprehensive report representing the result of many thousands of dollars of research work. Correlation of the various weldability tests with service experience will be indicated by several authors.

Probably no other subject is more important at the present time than aircraft welding in the application to welding and speeding up of the welding production. The movement has gained so much headway that three separate sessions will be devoted to aircraft welding. Papers will cover airplane propeller blades, the welding of special alloy steels used in aircraft tubing, the application of resistance welding in its various forms to aluminum and magnesium alloys, recommended standards for spot welding in the aircraft industry, the development of special electrodes, surveys of present practices and several other phases.

The Wire Association will, as usual, feature the Mordica Memorial Lecture, which this year will deal with "Steel and Wire," the author being Louis H. Winkler of Bethlehem Steel Co. Tungsten carbide applications will be another high spot of the program, and considerable interest undoubtedly will be displayed in the paper "Electric Patenting of Wire," by John P. Zur, Trauwood Engineering Co.

The companies exhibiting at the Congress are exceeding all expectations. Over 250 manufacturers have now reserved over 95 per cent of the available space in Cleveland's Public Auditorium. All indications are that these companies will feature educational and consulting services in their displays.

Correlated Technical Program

Monday, Oct. 12

9:30 A.M.

Effect of Elements in Solid Solution on Hardness and Response to Heat Treatment of Iron Binary Alloys, by C. R. Austin, Pennsylvania State College. A.S.M., Lattice Room, Hotel Statler.

Effect of Hardness on the Machinability of Six Alloy Steels, by O. W. Boston and L. V. Colwell, University of Michigan. A.S.M., Parlor 1, Hotel Statler.

Bursting Tests on Notched Alloy Steel Tubing, by G. Sachs and J. D. Lubahn, Case School of Applied Science. A.S.M., Ballroom, Hotel Statler.

10:00 A.M.

Third Element Effects on Hardenability of a Pure Hypereutectoid Iron-Carbon Alloy, by C. R. Austin, Pennsylvania State College, W. G. Van Note, North Carolina State College, and T. A. Prater, Pennsylvania State College. A.S.M., Lattice Room, Hotel Statler.

Carburizing Characteristics of 0.20 Per Cent Carbon Alloy and Plain Carbon Steels, by G. K. Manning, Republic Steel Corp. A.S.M., Parlor 1, Hotel Statler.

Notched Bar Tensile Tests on Heat Treated Low Alloy Steels, by G. Sachs and J. D. Lubahn, Case School of Applied Science. A.S.M., Ballroom, Hotel Statler.

10:15 A.M.

Training of Welding Foremen, by F. H. Achard, Consolidated Edison Co. of New York, Inc. A.W.S., Ballroom, Hotel Cleveland.

10:30 A.M.

"Ar" Range in Some Iron-Cobalt-Tungsten Alloys, by W. P. Sykes, General Electric Co. A.S.M., Lattice Room, Hotel Statler.

Metallography of Galvanized Sheet Steel Using a Specially Prepared Polishing Medium With Controlled pH, by D. H. Rowland and O. E. Romig, Carnegie-Illinois Steel Corp. A.S.M., Parlor 1, Hotel Statler.

Stress-Strain Measurements in the Drawing of Cylindrical Cups, by E. L. Bartholomew, Jr., Massachusetts Institute of Technology. A.S.M., Ballroom, Hotel Statler.

10:45 A.M.

Instruction Methods in Welding Developed by U. S. Office of Education, by H. K. Hogan, U. S. Office of Education. A.W.S., Ballroom, Hotel Cleveland.

11:00 A.M.

Fatigue Strength of Normalized and Tempered Versus As-Forged Full Size Railroad Car Axles, by O. J. Horger and T. V. Buckwalter, Timken Roller Bearing Co. A.S.M., Ballroom, Hotel Statler.

2:00 P.M.

Metallurgical Aspects of the National Emergency Steels. A.S.M. War Production Meeting, Ballroom, Hotel Statler.

Phase Diagram of the Copper-iron-silicon System from 90% to 100% Copper, by A. G. H. Anderson, Oakdale, N. Y., and W. A. Kingsbury, Phelps Dodge Corp. A.I.M.E., Pine Room, Hotel Statler.

A Study of Low Temperature Gaseous Reduction of a Magnetite, by M. C. Udy and C. H. Lorig, Battelle Memorial Institute. A.I.M.E., Euclid Ballroom, Hotel Statler.

Fatigue Strength of Metal Subjected to Combined Stresses, by L. H. Donnell, Illinois Institute of Technology. A.W.S., Red Room, Hotel Cleveland.

Some Special Applications of Flame Hardening, by Stephen Smith, Air Reduction Sales Co. A.W.S., Ballroom, Hotel Cleveland.

2:30 P.M.

Aluminum. A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Forming Characteristics (Deep Drawing Properties) and Tests Therefor", V. N. Krivobok, Lockheed Aircraft Co.; "Proper Heat Treatment for Formability, Strength, or Corrosion Resistance", John W. Dunn, Curtiss Aeroplane & Motor Co.; "Hardness Tests; Their Relationship to Strength, and Their Limitations", Richard L. Templin, Alcoa Research Laboratories; "Spot Welding in Production", Stewart L. Rich, Bell Aircraft Corp.; "Inspection of Spot Welded Joints", George S. Mikhalapov, Chairman A.W.S. Resistance Welding Standards Committee; "Correct Anodizing and Other Surface Treatments," J. B. Johnson, Army Air Corps; Summarization, Edgar H. Dix, Jr., Aluminum Co. of America.

Internal Friction of an Alpha Brass Crystal, by Clarence Zener, Washington State College and Watertown Arsenal. A.I.M.E., Pine Room, Hotel Statler.

Chromizing of Steel, by I. R. Kramer and Robert H. Hafner, Naval Research Laboratory, Washington. A.I.M.E., Euclid Ballroom, Hotel Statler.

Fatigue Strength of Commercial Butt Welds in Carbon Steel Plates, by W. M. Wilson, University of Illinois. A.W.S., Red Room, Hotel Cleveland.

High Quality Welding—Vertical and Overhead Positions with Alternating Current, by H. O. Westendarp, General Electric Co. A.W.S., Ballroom, Hotel Cleveland.

Opening Address, by President Carl E. Johnson. W.A., Hotel Carter.

3:00 P.M.

The Wire Industry's Part in Industrial Conservation, by Ivon B. Tilyou, Industrial Salvage Section, War Production Board. W.A., Hotel Carter.

3:15 P.M.

Note on Some Hardness Changes that Accompany the Ordering of Beta Brass, by Cyril Stanley Smith, War Metallurgy Committee, National Academy of Sciences, National Research Council. A.I.M.E., Pine Room, Statler Hotel.

Calculated Hardenability and Weldability of Carbon and Low-alloy Steels, by C. E. Jackson and G. G. Luther, Naval Research Laboratory, Anacostia Station. A.I.M.E., Euclid Ballroom, Statler Hotel.

Fatigue Tests of Full Thickness Plates with and without Butt Welds, by E. C. Huge, Babcock & Wilcox Co. A.W.S., Red Room, Hotel Cleveland.

Conservation and Effective Use of Equipment and Supplies for Welding and Cutting, by H. Ullmer, Linde Air Products Co. A.W.S., Ballroom, Hotel Cleveland.

3:30 P.M.

Sound Motion Picture: *Mines Above Ground.* Western Electric Co., W.A., Hotel Carter.

3:45 P.M.

Impact Strength of High Alloy Steel Welds, by E. C. Chapman, Combustion Eng. Co. A.W.S., Red Room, Hotel Cleveland.

Welding Gun Mounts, by W. B. Lair, York Safe & Lock Co. A.W.S., Ballroom, Hotel Cleveland.

Substitute Materials, Bell Telephone Laboratories. W.A., Hotel Carter.

4:00 P.M.

Employee Training in Metal-working Departments. A.S.M. War Production Meeting, Ballroom, Hotel Statler.

5:00 P.M.

Lecture Course on Tool Steels, *Definition and Classification of Tool Steels,* by H. G. Johnstin, Vanadium-Alloys Steel Co. A.S.M., Auditorium.

7:30 P.M.

Motion picture films: *The Inside of Welding,* by General Electric Co., *The Welding of Aluminum,* by Aluminum Co. of America, and *The Welding Technique,* by Oklahoma A. & M. College. A.W.S., Red Room, Hotel Cleveland.

Industrial research dinner. A.W.S., Rose Room, Hotel Cleveland.

8:00 P.M.

Doing More with What Alloys We Have by Using N. E. Steels, A.S.M. War Production Meeting, Auditorium.

"Experience in Use of N.E. Steels by the Automotive Truck and Allied Industries," W. Paul Eddy, Jr., General Motors Truck; "Experience in Use of N.E. Steels by the Oil Well Drilling Equipment Industries," Merton T. Archer, National Supply Co.; "Experience in Use of N.E. Steels by the Tractor and Farm Implement Industries," Hyman Bornstein, John Deere & Sons, Inc.; "Experience in Use of N.E. Steels by the Aircraft Engine Manufacturers," Arthur W. F. Green, Pratt & Whitney Aircraft Div.; "Experience in Use of N.E. Steels by the Machine Tool Builder," H. Stanley Binns, Cincinnati Milling Machine Co.; "Success of N.E. Steels in Meeting Ordnance Specifica-

Abbreviations of names of the various cooperating societies used in the following program are as follows: American Society for Metals — A.S.M.; American Institute of Mining and Metallurgical Engineers— A.I.M.E.; American Welding Society — A.W.S.; Wire Association — W.A.

Except for opening papers of morning and afternoon sessions, times given for presentation of papers are approximate, depending upon length of preceding papers and discussions.

tions for End-Product," Charles H. Herty, Bethlehem Steel Co.; Summarizer, Herbert J. French, president-elect, A.S.M.

Manufacture and Heat Treatment of Magnesium Castings, A.S.M. War Production Meeting, Auditorium.

"Formulation and Control of Foundry Sand", George W. Kuracheck, Wright Aeronautical Corp.; "Core Sand and Core Making Problems", M. E. Gantz, American Magnesium Corp.; "Precautions in Melting and Pouring Magnesium", Manley E. Brooks, Dow Chemical Co.; "Labor Saving Methods in Founding and Cleaning", Claude L. Stevens, Ford Motor Co.; "Heat Treatment and Requirements of Idle Furnaces That May Be Converted", Robert T. Wood, American Magnesium Corp.; "Inspection Problems", L. E. Pearch, Wellman Bronze & Aluminum Co.; Summarizer, B. Clements, Wright Aeronautical Corp.

Salvage of Broken Tools and Maintenance of Equipment, A.S.M. War Production Meeting, Auditorium.

Tuesday, Oct. 13

9:30 A.M.

The End Quench Test: Reproducibility, by Morse Hill, Wright Field. A.S.M., Lattice Room, Hotel Statler.

The Alpha Iron Lattice Parameter as Affected by Molybdenum, and an Introduction to the Problem of the Partition of Molybdenum in Steel, by F. E. Bowman, R. M. Parke and A. J. Herzig, Climax Molybdenum Co. A.S.M., Ballroom, Hotel Statler.

The Method of Thin Films for the Study of Intermetallic Diffusion and Chemical Reactions at Metallic Surfaces, by H. S. Coleman and H. L. Yeagley, Pennsylvania State College. A.S.M., Parlor 1, Hotel Statler.

Rare Metals and the War Effort, by W. P. Sykes, Conservation Division, W.P.B. A.I.M.E., Pine Room, Statler Hotel.

What Happens to Residual Stresses in Service, by J. T. Norton and D. Rosenthal, Massachusetts Institute of Technology. A.W.S., Ballroom, Hotel Cleveland.

Welding of Airplane Propeller Blades, by C. A. Liedholm, Curtiss-Wright Corp. A.W.S., Red Room, Hotel Cleveland.

Reducing Accidents in Wire and Wire Products Operations, by R. H. Ferguson, Republic Steel Corp. W.A., Hotel Carter.

10:00 A.M.

The End-Quench Test: Hardenability of Aircraft Steels and Its Representation, by Morse Hill, Wright Field. A.S.M., Lattice Room, Hotel Statler.

The Effect of Molybdenum on the Isothermal, Sub-Critical Transformation of Austenite in Eutectoid and Hypereutectoid Steels, by J. R. Blanchard, R. M. Parke and A. J. Herzig, Climax Molybdenum Co. A.S.M., Ballroom, Hotel Statler.

On the Location of Flaws by Stereo-Radiography, by James Rigbey, Ford Motor Co. of Canada. A.S.M., Parlor 1, Hotel Statler.

True Stress-Strain Relations at High Temperature, by R. S. Dean, Bureau of Mines. A.I.M.E., Pine Room, Statler Hotel.

True Stress-strain Relations at High Temperatures by the Two-Load Method, by C. W. MacGregor, Massachusetts Institute of Technology, and L. E. Walsh, Bakelite Corp. A.I.M.E., Euclid Ballroom, Statler Hotel.

Effects of Cooling Rate on the Properties of Arc Welded Joints, by W. F. Hess, Rensselaer Polytechnic Institute. A.W.S., Ballroom, Hotel Cleveland.

Welding of New Types of Alloy Steels for Aircraft Structures, by A. R. Lytle and K. H. Koopman, Union Carbide and Carbon Research Laboratories. A.W.S., Red Room, Hotel Cleveland.

10:30 A.M.

Hardenability Control of a One Per Cent Carbon Steel, by G. R. Barrow and Gilbert Soler, Timken Roller Bearing Co. A.S.M., Lattice Room, Hotel Statler.

The Effect of Molybdenum on the Rate of Diffusion of Carbon in Austenite, by J. L. Ham, R. M. Parke and A. J. Herzig, Climax Molybdenum Co. A.S.M., Ballroom, Hotel Statler.

The Fluorescent Penetrant Method of Detecting Discontinuities, by Taber de Forest, Magnaflux Corp. A.S.M., Parlor 1, Hotel Statler.

The Use of Silver During the Emergency, by R. H. Leach and John L. Christie, Handy & Harman. A.I.M.E., Pine Room, Statler Hotel.

The Calculation of the Tensile Strength of Normalized Steels from Chemical Composition, by F. M. Walters, Jr., Naval Research Laboratory, Anacostia Station. A.I.M.E., Euclid Ballroom, Statler Hotel.

Scheduling and Planning the Wire Mill for War Production, by L. D. Seymour, Canada Works, Steel Company of Canada, Ltd. W.A., Hotel Carter.

11:00 A.M.

The Effect of Certain Elements on the Rate of Tarnishing of Silver Alloys, by W. E. Campbell, Bell Telephone Laboratories. A.I.M.E., Pine Room, Statler Hotel.

Effect of Silicon on Hardenability, by Walter Crafts and J. L. Lamont, Union Carbide and Carbon Research Laboratory, Inc. A.I.M.E., Euclid Ballroom, Statler Hotel.

Weld Quench Gradient Tests, by W. H. Bruckner, University of Illinois. A.W.S., Ballroom, Hotel Cleveland.

Effect of Current on the Welding of X4130 Sheet and Tubing, by W. T. Tiffin, University of Oklahoma. A.W.S., Red Room, Statler Hotel.

11:30 A.M.

Bismuth Solders and Other New Applications of Bismuth, by A. J. Phillips, American Smelting and Refining Co. A.I.M.E., Pine Room, Statler Hotel.

12:15 P.M.

Iron and Steel Division executive committee luncheon. A.I.M.E., Parlor K, Statler Hotel.

1:00 P.M.

Annual luncheon, Speakers: Dr. Charles Copeland Smith, National Association of Manufacturers, and Army and Navy representatives. W.A., Hotel Carter.

2:00 P.M.

Doing More With Available Tool Steels, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"The Critical Situation in Tool Alloys", Ernest Hergenroether, War Production Board; "Cutting-Tools Containing Little or No Vanadium; Heat Treatment and Use", David I. Dillworth, Crucible Steel Co. of America; "Savings Through Standardization To Both Manufacturer and User", Norman I. Stotz, Universal-Cyclops Steel Corp.; "Ekeing-out Tool Materials by Use of Inserts and Tins (Carbide)", Donald G. Clark, Firth-Sterling Co.; "Developments in the Art of High Speed Cutting of Harder Steels", Hans Ernst, Cincinnati Milling Machine Co.; "Avoiding Production Delays by Accurate Trouble Shooting", Frank R. Palmer, Carpenter Steel Co.; "Conservation and Salvage of Cutting Tools (Tool Steels)", A. L. Boyle, International Harvester Co.; Summarizer, James P. Gill, Vanadium Alloys Steel Co.

Elements A La Carte: A Summary of the Status of Artificially Produced Elements and Some of Their Applications, by K. K. Darrow, Bell Telephone Laboratories. A.I.M.E., Pine Room, Hotel Statler.

Duplex Process for Manufacture of Basic Open-hearth Steel, by H. B. Emerick and S. Feigenbaum, Jones & Laughlin Steel Corp. A.I.M.E., Euclid Ballroom, Hotel Statler.

Weldability of Carbon-Manganese Steels, by O. E. Harder and C. B. Voldrich, Battelle Memorial Institute. A.W.S., Ballroom, Hotel Cleveland.

Spot Welding in Aircraft Structures, by E. S. Jenkins, Curtiss-Wright Corp. A.W.S., Assembly B, Hotel Cleveland.

Gas Cutting in Steel Mills, by S. D. Baumer, Air Reduction Sales Co. A.W.S., Red Room, Hotel Cleveland.

2:30 P.M.

Speeding Production by Improving Metal Cutting Practice (Part I), A.S.M. War Production Meeting, Ballroom, Hotel Statler.

Rare Elements in the Electrical Industry, by Porter H. Brace, Westinghouse Electric & Mfg. Co. A.I.M.E., Pine Room, Hotel Statler.

The Effects of Tin on the Properties of Plain Carbon Steel, by J. W. Halley, Inland Steel Co. A.I.M.E., Euclid Ballroom, Hotel Statler.

Weldability Tests of Carbon-Manganese Steels, by C. E. Jackson, M. A. Pugacz and G. G. Luther, Naval Research Laboratory. A.W.S., Ballroom, Hotel Cleveland.

Standards and Recommended Practices and Procedures for Spot Welding Aluminum Alloys, by G. S. Mikhalapov, Aircraft Welding Standards Committee chairman. A.W.S., Assembly B, Hotel Cleveland.

Improved Methods of Machine Flame Cutting, by H. E. Rockefeller, Linde Air Products Co. A.W.S., Red Room, Hotel Cleveland.

3:00 P.M.

Rare Elements in the Glass Industry, by M. B. Vilensky, Owens-Corning Fiberglas Corp. A.I.M.E., Pine Room, Hotel Statler.

3:15 P.M.

Jominy End Quench Hardenability Tests on Carbon-Manganese Steels, by G. A. Timmons, Climax Molybdenum Co. A.W.S., Ballroom, Hotel Cleveland.

Arc Welding of Magnesium Alloys, by W. S. Loose and A. R. Orban, Dow Chemical Co. A.W.S., Assembly B, Hotel Cleveland.

Gas Cutting in Shipbuilding, by R. F. Helmkamp, Air Reduction Sales Co. A.W.S., Red Room, Hotel Cleveland.

3:30 P.M.

Notes on Refractory Metal-Base Compound Materials, by C. G. Goetzel, American Sinteel Co. A.I.M.E., Pine Room, Hotel Statler.

Cause of Bleeding in Ferrous Castings, by C. A. Zappfe, Battelle Memorial Institute.

Hotels Where Societies Will Have Headquarters

Headquarters will be maintained by the various societies during the Metal Congress, at the following hotels: American Institute of Mining and Metallurgical Engineers at the Statler Hotel; American Welding Society at the Hotel Cleveland; American Society for Metals at the Hotel Statler, and Wire Association at the Hotel Carter.

A.I.M.E., Euclid Ballroom, Hotel Statler.

4:00 P.M.

Interpretation of Magnaflux and Other Surface Inspection Tests, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Interpretation, Potency, Standards and Correct Application of Magnaflux in Steel Bar Manufacture", A. D. Beeken, Vulcan Crucible Steel Co.; "Interpretation, Potency, Standards and Correct Application of Magnaflux Testing of Finished Parts", John Gold Thwaite, Allison Engine Co.; "Interpretation, Potency, Standards and Correct Application of Magnaflux Testing of Locomotive Parts & Railroad Rolling Stock", Ray McBrian, Denver & Rio Grand West. Railway Co.; "Use of Fluorescent Liquids to Locate Surface Defects", Greer Ellis, Magnaflux Corp.; "Use of Chromate and Other Dips to Prove Sound Surfaces on Aluminum and Magnesium Parts", C. F. Nagel, Jr., Aluminum Co. of America; Summarizer, L. A. Danse, Cadillac Motor Car Co.

Time-to-fracture Tests on Platinum, Platinum-iridium, and Platinum-rhodium Alloys, by H. E. Stauss, Baker & Co., Inc. A.I.M.E., Pine Room, Statler Hotel.

Tee-Bend Tests on Carbon-Manganese Steels, by L. C. Bibber and J. Heuschkel, Carnegie-Illinois Steel Corp. A.W.S., Ballroom, Hotel Cleveland.

Welding—Its Application to Aircraft, by Francis H. Stevenson, Vega Aircraft Corp. A.W.S., Assembly B, Hotel Cleveland.

Annual meeting, W. A. Hotel Carter.

5:00 P.M.

Lecture Course in Tool Steel, *Effect of Alloying Elements*, by R. S. Rose, Vanadium-Alloys Steel Co. A.S.M., Auditorium.

7:00 P.M.

Annual dinner of metals division; speaker: Earle C. Smith, A.I.M.E., Hotel Statler.

7:30 P.M.

Fundamental Research Conference. A.W.S., Red Room, Hotel Cleveland.

8:00 P.M.

Selection of Proper Die Steels for Mass Production, A.S.M. War Production Meeting, Auditorium.

"Die Steels for Manufacturing Die Castings", Joseph C. Fox, Doehler Die Casting Co.; "Improving the Life and Accuracy of Dies", J. A. Succop, Heppenstall Co.; "Ways and Means of Increasing Die Life in the Cupping and Deep Drawing of Brass", Sam Spalding, American Brass Co.; "Dies for Hot Forging of Aluminum (Hammers and Presses); L. W. Davis, Aluminum Co. of America; "Dies for Stamping and Drawing of Aluminum Sheet", V. N. Krivobok, Lockheed Aircraft Co.; "Standardization of Drawing Dies in a Small Arms Shop", Earl Glen, Carboloy Co., Inc.; Summarizer; Robert B. Schenck, Buick Motor Co.

Use and Interpretation of Radiography As An Inspection Method, A.S.M. War Production Meeting, Auditorium.

"Selection and Training of Operators", O. R. Carpenter, Babcock & Wilcox Co.; "Production Standardization of Technique and Material", Tom A. Triplett, Triplett & Barton; "Acceptance and Rejection Standards for Light Alloy Castings", W. H. Burroughs, Glenn L. Martin Aircraft Co.; "Sampling (Determination of Proportion of Castings That Should Be Radiographed," James Bly, Pratt & Whitney Aircraft Div.; "Limitations of Radiography As An Inspection Method (Proper & Improper Applications)", Arthur J. Sikora, Wright Aeronautical Corp.; "New Developments in Equipment, Films, Technique", L. W. Ball, National Research Labs.; "Reports, Techniques, Standard Practices to Comply with Government Specifications", Robert Katz, Army Air Corps; Summarizer, Kent R. Van Horn, Aluminum Co. of America.

Speeding Production by Improved Metal Cutting Practice (Part II), A.S.M. War Production Meeting, Auditorium.

Wednesday, Oct. 14

9:00 A.M.

Annual Meeting of the American Society for Metals, *1942 Edward de Mille Campbell Memorial Lecture*, by John Chipman, Massachusetts Institute of Technology. Ballroom, Hotel Statler.

9:30 A.M.

Refrigerant Cooled Spot Welding Electrodes, by F. R. Hensel, E. I. Larsen and E. F. Holt, P. R. Mallory & Co. A.W.S., Assembly B, Hotel Cleveland.

Welding with Aluminum Bronze, by Clinton E. Swift, Ampco Metal, Inc., A.W.S., Red Room, Hotel Cleveland.

9:45 A.M.

Tungsten Carbide Applications, by A. MacKenzie, Carboloy Co., Inc. W.A., Hotel Carter.

10:00 A.M.

Spot Welding of 0.040 in. Thickness SAE X4130 Steel, by W. F. Hess and D. C. Herrschaft, Rensselaer Polytechnic Institute. A.W.S., Assembly B, Hotel Cleveland.

Benjamin F. Shepherd

Chief Metallurgist of Ingersoll-Rand Co. and Past President of American Society for Metals. He will be awarded the Albert Sauveur Achievement Award.

Adapting Automatic Electric Welding to Routine Production, by J. M. Keir, Linde Air Products Co. A.W.S., Red Room, Hotel Cleveland.

10:30 A.M.

Steel and Wire, by Louis H. Winkler, Bethlehem Steel Co. W.A., Hotel Carter.

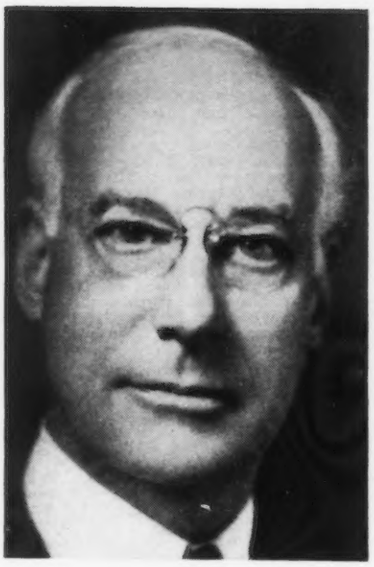
10:45 A.M.

Unusual Resistance Welding Developments and Operations, by R. T. Gillette, General Electric Co. A.W.S., Assembly B, Hotel Cleveland.

Welded Steel Tube and Its Application in War Production, by H. S. Card, Formed Steel Tube Institute. A.W.S., Red Room, Hotel Cleveland.

11:15 A.M.

Resistance Welding Trench Mortar Fin Assembly, by J. H. Cooper, Taylor-Winfield Corp. A.W.S., Assembly B, Hotel Cleveland.



Bradley Stoughton

Professor of Metallurgy at Lehigh University and President of the American Society for Metals.

12:00 Noon

A.S.M., Alumni Luncheons, Hotel Statler.

12:15 P.M.

Institute of Metals Division executive committee luncheon. A.I.M.E., Parlor K, Statler Hotel.

2:00 P.M.

Making More Steel in Open Hearth Plants, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Speeding Charging Time by (a) Trimmer Charge Boxes (b) Close Timing of Charging Drags (c) Handling Hot Metal," W. H. Yeckley, Youngstown Sheet & Tube Co.; "Long and Uninterrupted Furnace Campaigns (Roof Maintenance, Hot Re airs, Refractory Qualities, Short Rebuilding Time)," E. E. Callinan, Timken Steel & Tubes; "Working of High Iron Charges by (a) Minimizing Silicon in Basic Iron (b) Disposal of Run-Off Slag (c) Oxidation with Ore or Stone," C. R. FonDersmith, American Rolling Mill; "Open-Hearth as a Direct Reducer of Iron from Ore (a) Precautions to Avoid Loss of Production & Quality (b) Comparative Value of Lump Ore, Sinter, or Briquettes," Clyde Denlinger, Bethlehem Steel Co.; "Making the Most of Scrap by (a) Segregation by Alloy Content (b) Scheduling Use of Sub-Standard Grades," Gilbert Soler, Timken Roller Bearing Co.; "Cooperation With Blooming Mill to Get Maximum Yield from Ingots (Also Good Pit Practices to Achieve Same Ends)," A. P. Miller, Inland Steel Co.; "Solving the Personnel Problem in the Expansion of Plants and Loss of Key Men to the Service," E. A. Schwartz, Republic Steel Corp.; Summarizer, Earle C. Smith, Republic Steel Corp.

Problems Associated With the Large Expansion of the Steel Foundry Industry, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"The Problem of Obtaining Adequate Melters and Molders," F. A. Melmoth, Detroit Steel Castings Co.; "The Long Range Personnel Problem; Apprentice Training Programs," E. O. Jones, Racine Steel Castings Co.; "Conversion of Iron Foundries Into Steel Foundries," John Howe Hall, Consulting Engineer; "Converting Cupola Iron to Steel," W. J. Phillips, Symington-Gould Corp.; "Duplex (or Triplex) Steel—Cupola to Converter to Electric Furnace," R. H. McCarroll, Ford Motor Co.; "Scraping Up the Scrap (and Other Raw Materials)," W. W. McMillen, National Malleable & Steel Castings Co.:

H. J. French

Charge of Alloy Steel and Iron Development, International Nickel Co. President-elect of the American Society for Metals.

"Conversion of Idle Furnace Equipment to the Heat Treatment of Steel Castings," Charles S. Pearce, Porcelain Enamel Institute; Summarizer, Charles W. Briggs, Steel Founders' Society of America.

The Rate of Precipitation of Silicon from the Solid Solution of Silicon in Aluminum, by L. K. Jetter, Aluminum Co. of America, and Robert F. Mehl, Carnegie Institute of Technology. A.I.M.E., Pine Room, Statler Hotel.

Silicon-Oxygen Equilibria in Liquid Iron, by C. A. Zappfe and C. E. Sims, Battelle Memorial Institute. A.I.M.E., Euclid Ballroom, Statler Hotel.

The Spot Welding of NAX High Tensile Steel, by C. R. Schroder, Great Lakes Steel Corp. A.W.S., Assembly B, Hotel Cleveland.

Factors Affecting the Accuracy of Ordnance Machine Cutting, by Howard Hughey and A. H. Yoch, Air Reduction Sales Co. A.W.S., Ballroom, Hotel Cleveland.

Suggested Methods Which Will Increase Welding Production and Decrease Welding Costs, by J. F. Lincoln, Lincoln Electric Co. A.W.S., Red Room, Hotel Cleveland.

Trouble Shooting on Bronze and Steel Weaving Wire, by L. D. Granger, Wickwire Spencer Steel Co. W.A., Hotel Carter.

2:30 P.M.

Equilibrium Diagrams and Lattice Spacing Relationships in the Systems Magnesium-tin and Magnesium-lead, by Geoffrey V. Raynor, Oxford University, England. A.I.M.E., Pine Room, Statler Hotel.

Equilibria of Liquid Iron and Simple Basic and Acid Slags in a Rotary Induction Furnace, by C. R. Taylor, American Rolling Mill Co., and John Chipman, Massachusetts Institute of Technology. A.I.M.E., Euclid Ballroom, Statler Hotel.

Application of Copper Oxides Rectifiers for Resistance Welding, by R. L. Briggs, Thomson Gibb Electric Welding Co. A.W.S., Assembly B, Hotel Cleveland.

Manual and Automatic Welding of Heavy Plate of Hardenable Alloys, by L. A. Danse, Cadillac Motor Car Division. A.W.S., Ballroom, Hotel Cleveland.

Distortion and Shrinkage Problems in Ships and Other Large Structures, by Lamotte Grover, Air Reduction Co. A.W.S., Red Room, Hotel Cleveland.

3:00 P.M.

Welding Electrodes, by Dr. John W. Miller, Reid-Avery Co. W.A., Hotel Carter.

3:15 P.M.

Constitution of Lead-rich and Lead-antimony Alloys, by W. S. Pellini and F. N. Rhines, Carnegie Institute of Technology. A.I.M.E., Pine Room, Statler Hotel.

The Effect of Weld Spacing on the Strength of Spot-Welded Joints, by R. Della-Vedowa and M. M. Rockwell, Lockheed Aircraft Corp. A.W.S., Assembly B, Hotel Cleveland.

Developments in Cast Iron Welding Rods and Electrodes, by R. J. Franklin, Chicago Hardware Foundry Co. A.W.S., Ballroom, Hotel Cleveland.

Motor Boat Construction and Small Ships, by W. E. Whitehouse, Defoe Shipbuilding Co. A.W.S., Red Room, Hotel Cleveland.

4:00 P.M.

Use of Powdered Metals in War Production and Tools, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Raw Material, Processes and Uses of Copper Powders," Paul E. Weingart, U. S. Metals Refining Co.; "Supply of Necessary Non-Ferrous Powders to Blend with Copper," Don Noel, Metals Disintegrating Co.; "Manufacture of Iron Powder of High Quality," John Wulff, Massachusetts Inst. of Tech.; "Substitution of Iron for Non-Ferrous Powders," Earl Patch, Moraine Products; "Supply and Use of Tungsten Powders for Tools and Electrical Equipment," Zay Jeffries, The Carboloy Co.; "Recent Achievements in Powder Metallurgy," Gregory J. Comstock, Stevens Inst. of Tech.; Summarizer, Philip M. McKenna, McKenna Metals Company.

John Chipman

Professor of Metallurgy at Massachusetts Institute of Technology. He will deliver this year's Campbell Memorial Lecture.

Preparation of Aluminum Alloy for Spot Welding, by T. E. Piper, Northrop Aircraft, Inc. A.W.S., Assembly B, Hotel Cleveland.

Electric Welding of Mobile Artillery Gun Carriages, by G. E. Campbell, Pettibone-Mulliken Corp. A.W.S., Ballroom, Hotel Cleveland.

Application of Welding in Submarine Construction, by E. H. Ewertz, Electric Boat Co., and R. D. West, Manitowoc Shipbuilding Co. A.W.S., Red Room, Hotel Cleveland.

5:00 P.M.

Lecture Course in Tool Steel, *Carbon Tool Steels*, by R. B. George, Vanadium-Alloys Steel Co. A.S.M., Auditorium.

7:30 P.M.

Section officers' dinner and conference. A.W.S., Rose Room, Hotel Cleveland.

Annual dinner and stag smoker, W.A., Hotel Carter.

8:00 P.M.

Increasing Yields of Electric Furnaces (Electric Steel Manufacture), A.S.M. War Production Meeting, Auditorium.

Doing More With Low-alloy and Carbon Steels by Use of Special Additions in Steel Manufacture (Intensifiers), A.S.M. War Production Meeting, Auditorium.

Recruiting, Training and Handling Inspectors of Metallurgical Material, A.S.M. War Production Meeting, Auditorium.

"Recruiting of Inspection Personnel," James A. Campbell, U. S. Civil Service Comm.; "Metallurgical Fundamentals of the Training Course." Le Roy L. Wyman, General Electric Co.; "Coordination of Class Room Work with Training on the Job," Lt. Col. George M. Enos, Cincinnati Ordnance Dist.; "Latitude of Inspection in Terms of Meeting Both the Intent of the Specifications and the Production Schedule," Dr. John W. W. Sullivan, Cleveland Ordnance Dist.; "Women as Inspectors," C. H. Dustin, U. S. Office of Education; "Managing a Large Inspection Staff," Maurice Hester, Willys-Overland; Summarizer, Max Robinson, Penn College.

Thursday, Oct. 15

9:30 A.M.

A Metallographic Study of the Formation of Austenite From Aggregates of Ferrite and Cementite in an Iron-Carbon Alloy of 0.5 Per Cent Carbon, by T. G. Digges and S. J. Rosenberg, National Bureau of Standards. A.S.M., Ballroom, Hotel Statler.

The Tantalum-Carbon System, by F. H. Ellinger, General Electric Co. A.S.M., Parlor 1, Hotel Statler.

Corrosion of Water Pipes in a Steel Mill, by C. L. Clark, Timken Roller Bearing Co., and W. J. Nungester, University of Michigan. A.S.M., Lattice Room, Hotel Statler.

Utility Characteristics of Aircraft Electrodes, by C. B. Voldrich and R. D. Williams, Battelle Memorial Institute. A.W.S., Red Room, Hotel Cleveland.

Correlation of Metallographic and Radiographic Examinations of Spot Welds in Aluminum Alloys, by Dana W. Smith and Fred Keller, Aluminum Co. of America. A.W.S., Assembly B, Hotel Cleveland.

9:45 A.M.

Submerged Combustion Takes Its Place in the War Industries, by Walter G. See, Submerged Combustion Co. of America. W.A., Hotel Carter.

10:00 A.M.

Influence of Initial Structure and Rate of Heating on the Austenitic Grain Size of 0.5 Per Cent Carbon Steels and Iron-Carbon Alloy, by T. G. Digges and S. J. Rosenberg, National Bureau of Standards. A.S.M., Ballroom, Hotel Statler.

Influence of Strain Rate on Strength and Type of Failure of Carbon-Molybdenum Steel at 850, 1000 and 1100 Degrees Fahr., by R. F. Miller and G. V. Smith, U. S. Steel Corp., and G. L. Kehl, Columbia University. A.S.M., Parlor 1, Hotel Statler.

A Study of the Iron-Rich Iron-Manganese Alloys, by A. R. Troiano, University of Notre Dame, and F. T. McGuire, University of Kentucky. A.S.M., Lattice Room, Hotel Statler.

Results of Survey on Current Arc Welding Practice in Aircraft Industry, by Maurice Nelles, Western Aircraft Welding Committee. A.W.S., Red Room, Hotel Cleveland.

The Magnetic Powder Method for Inspecting Weldments and Castings for Sub-Surface Defects, by Carleton Hastings, Watertown Arsenal. A.W.S., Assembly B, Hotel Cleveland.

10:30 A.M.

Electric Patenting of Wire, by John P.

Zur, Trauwood Engineering Co. W.A., Hotel Carter.

10:45 A.M.

Copper Welding for Aircraft, by T. V. Buckwalter, Timken Roller Bearing Co. A.W.S., Red Room, Hotel Cleveland.

Radiographic Inspection of Welded Armor Plates and Castings, by Don M. McCutcheon, Ford Motor Co. A.W.S., Assembly B, Hotel Cleveland.

10:30 A.M.

The Mechanism and the Rate of Formation of Austenite from Ferrite-Cementite Aggregates, by G. A. Roberts, Vanadium-Alloys Steel Co., and R. F. Mehl, Carnegie Institute of Technology. A.S.M., Ballroom, Hotel Statler.

Rupture Tests at 200 Degrees Cent. on Some Copper Alloys, by E. R. Parker and C. Ferguson, General Electric Co. A.S.M., Parlor 1, Hotel Statler.

The Induction Furnace as a High Temperature Calorimeter and the Heat of Solution of Silicon in Liquid Iron, by John Chipman and N. J. Grant, Massachusetts Institute of Technology. A.S.M., Lattice Room, Hotel Statler.

11:30 A.M.

Visual Inspection of Arc Welds, by W. L. Warner, Watertown Arsenal. A.W.S., Assembly B, Hotel Cleveland.

12:15 P.M.

Physical Chemistry of Steelmaking committee luncheon. A.I.M.E., Parlor L, Statler Hotel.

1:30 P.M.

Plant Inspection—Electric Patenting of Wire. W.A., Hotel Carter.

2:00 P.M.

Speeding the Job by Better Production Heating for Softening, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Control of Scale in Soaking Pits," Charles L. Labeka, Pittsburgh Steel Co.; "Control of Scale in Reheating Furnaces," Julius Strassburger, Weirton Steel Co.; "Control of Scale in Forging Furnaces," Robert W. Schlumpf, Hughes Tool Co.; "Rapid Annealing Cycles for Machinability," S. Lind Widrig, Spicer Mfg. Co.; "Relative Advantages of Normalizing and Annealing to (a) Production and (b) Use," J. D. Armour, Republic Steel Corp.; "Surface Protection During Process Annealing After Deep Drawing," George Pugh, Babcock & Wilcox Co.; "Conversion of Old Furnaces to War Production," James Ludley Miller, Republic Steel Corp.; Summarizer, Frederick C. Young, Ford Motor Co.

Better Use of Secondary Metals, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Putting Scrap into Cooper Alloy Ingots That Meet Ordnance Requirements," Wm. Romanoff, H. Kramer & Co.; "Aluminum Secondaries (Harmful and Harmless Impurities)," Walter Bonsack, National Smelting Co.; "Tin Reclamation," Frederic W. Williard, Nassau Smelting & Refining Co.; "Recovery of Lead Alloys, Especially Babbitts and Solders," Albert J. Phillips, American Smelting & Refining Co.; "Handling Very Impure Mixture from Domestic Scrap Collection," E. W. Roath, War Production Board; Summarization, R. D. T. Hallowell, Non-Ferrous Ingot Metal Institute.

4:00 P.M.

Programs for Segregation, Collection and Reclamation of Metal Scrap, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Segregation of Active Scrap (in Process)," R. W. Hughes, Caterpillar Tractor Co.; "Steps to Minimize Amount of Scrap Produced," J. L. Cannon, General Motors Corp.; "Plant Organization Necessary in a Large Plant," George A. Tubb, Wright Aeronautical Corp.; "Plant Organization Suitable for a Medium Sized Plant," Mr. Read, Timken Roller Bearings Co.; "Plant Organization Suitable for a Small Sized Plant," H. F. Keen, Lincoln Electric Co.; "Modern Chip Handling Procedure," A. M. Perrin, National Conveyors Co.; "Disposal of Recoveries," Harry Beattie, General Electric Co.; Summarizer, R. H. Schmidt, Westinghouse Electric & Mfg. Co.

5:00 P.M.

Lecture Course in Tool Steel, *Chromium and Tungsten Steels for Hot or Cold Work*, by G. A. Roberts, Vanadium-Alloys Steel Co. A.S.M., Auditorium.

7:00 P.M.

Annual Dinner of the American Society for Metals, Ballroom, Hotel Statler.

Friday, Oct. 16

9:30 A.M.

The Hardening of Tool Steels, by Peter Payson and J. L. Klein, Crucible Steel Company of America. A.S.M., Ballroom, Hotel Statler.

Some Aspects of Strain Hardenability of Austenitic Manganese Steel, by D. Nicoff, Republic Steel Corp. A.S.M., Parlor 1, Hotel Statler.

The Metallography of Commercial Magnesium Alloys, by J. B. Hess and P. F. George, The Dow Chemical Co. A.S.M., Lattice Room, Hotel Statler.

10:00 A.M.

The Kinetics of Austenite Decomposition in High Speed Steel, by Paul Gordon and Morris Cohen, Massachusetts Institute of Technology, and Robert S. Rose, Vanadium-Alloys Steel Co. A.S.M., Ballroom, Hotel Statler.

The Precipitation Reaction in Aged Cold-Rolled One Per Cent Cd-Cu: Its Effects on Hardness, Conductivity, and Tensile Properties, by R. H. Harrington and L. E. Cole, General Electric Co. A.S.M., Parlor 1, Hotel Statler.

Study of Inverse Segregation Suggests New Method of Making Certain Alloys, by M. L. Samuels, Babcock and Wilcox Tube Co., A. R. Elsea and K. Grube, Battelle Memorial Institute. A.S.M., Lattice Room, Hotel Statler.

10:30 A.M.

The Tempering of Two High-Carbon High-Chromium Steels, by Otto Zmeskal, Illinois Institute of Technology, and Morris Cohen, Massachusetts Institute of Technology. A.S.M., Ballroom, Hotel Statler.

The Effect of Moderate Cold Rolling on the Hardness of the Surface Layer of 0.3½ Per Cent Carbon Steel Plates, by Harry K. Herschman, National Bureau of Standards. A.S.M., Parlor 1, Hotel Statler.

Effects of Various Solute Elements on the Hardness and Rolling Texture of Copper, by R. M. Brick, Yale University, D. L. Martin, General Electric Co., and R. P. Angier, Handy & Harmon. A.S.M., Lattice Room, Hotel Statler.

2:00 P.M.

Speeding the Job by Better and Faster Production Hardening, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Minimum Heat (and Time) Necessary," Elbert S. Rowland, Timken Roller Bearings Co.; "Improvement of the Quench (e.g., for Armor Piercing Shot)," Major Wayne L. Cockrell, Detroit Ordnance District; "Control of Wear-age (e.g., Armor Plate)," Virgil W. Whitmer, Republic Steel Corp.; "Surface Hardening by Induction Heating," Wm. E. Benninghoff, Ohio Crankshaft Co.; "Surface Hardening Ordnance Parts with Oxy-Acetylene Flame," John J. Crowe, Air Reduction Co.; "Surface Hardening by Gas-Air Flames," Frederic O. Hess, The Selas Co.; "Hardening by Nitriding and Carbo-Nitriding," Vernon E. Hense, Buick Motor Co.; Summarizer, O. W. McMullan, Youngstown Sheet & Tube Co.

Getting By With Low Tin Alloys, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

"Bronzes That Conserve Strategic Metals," Chester B. Hamilton, Jr., Hamilton Gear & Mach. Co.; "Low Tin Bearing Metals," E. L. Neiswander, Buckeye Machine Co.; "Thin Walled Bearings," Carl E. Swartz, Cleveland Graphite Bronze Co.; "Conserving Strategic Metals in Railway Car Brasses," E. S. Pearce, Railway Service & Supply Corp.; "Low Tin Solders, Use and Manipulation," A. A. Smith, Jr., American Smelting & Refining Co.; "Electro-Tin Coatings," Roger Lueck, American Can Co.; Summarizer, Carter S. Cole, War Production Board.

4:00 P.M.

Methods and Materials for Surface Protection, A.S.M. War Production Meeting, Ballroom, Hotel Statler.

5:00 P.M.

Lecture Course on Tool Steels, *High-Speed Steels*, by James P. Gill, Vanadium-Alloys Steel Co. A.S.M., Auditorium.

Exhibitors at the Metal Congress

Acme Electric Welding Co., Huntington Park, Calif. Booth A-500.

Advance Polishing Wheels, Inc., Chicago. Booth E-113.

Agfa Ansco Div., General Aniline & Film Corp., Binghamton, N. Y. Booth C-238.

Alox Corp., Niagara Falls. Booth B-516.

Aluminum Co. of America, Pittsburgh. Booth C-421.

Aluminum Ore Co. Booth C-421.

Alvey Ferguson Co., Cincinnati. Booth S-162.

American Brake Shoe & Fdry., New York City. Booths A-525 and B-320.

American Brass Co., Waterbury, Conn. Booth A-321.

American Car and Foundry Co., New York. Booth B-314.

American Foundry Equipment Co., Mishawaka, Ind. Booth D-340.

American Gas Furnace Co., Elizabeth, N. J. Booth B-103.

American Institute of Mining and Metallurgical Engineers, Inc., New York. Booth B-508.

American Machine and Metals, Inc. Booth A-418.

American Machinist, New York. Booth E-137.

American Magnesium Corp. Booth C-421.

American Manganese Steel Div. of American Brake Shoe & Fdry. Co., Chicago Heights, Ill. Booth A-525.

American Metal Market, New York. Booth D-319.

American Society for Metals, Cleveland.

American Welding Society, New York. Booth A-427.

Ampco Metal, Inc., Milwaukee, Wis. Booth B-131.

Anderson & Brown Co., Cleveland. Booth B-137.

Anderson & Sons, Westfield, Mass. Booth B-421.
Andresen, Inc., Pittsburgh, Booth B-210.
Armstrong Cork Co., Lancaster, Pa. Booth D-138.
Atlas Fdry. Co., Detroit. Booth B-320.
Atlas Publishing Co., New York City. Booth C-229.
Atlas Steels Ltd., Welland, Ont., Canada. Booth D-113.
Automatic Temperature Control Co., Inc., Philadelphia. Booth E-117.
Automotive and Aviation Industries, Philadelphia. Booth C-203.
Babcock & Wilcox Co., New York. Booth C-325.
Baker & Co., Inc., Newark, N. J. Booth B-415.
Banner Iron Works, St. Louis. Booth B-320.
Barnett Fdry. & Machine Co., Irvington, N. J. Booth B-320.
Bastian-Blessing Co., Chicago. Booth C-131.
Bausch & Lomb Optical Co., Rochester, N. Y. Booth D-150.
Behr-Manning Corp., Troy, New York. Booth C-141.
Black Drill Co., Cleveland. Booth D-146.
Blast Furnace and Steel Plant. Booth B-514.
Blue Book. Booth A-314.
Brickseal Refractory Co., Hoboken, N. J. Booth A-509.
Brickseal Refractory Co., Cleveland. Booth A-509.
Bridgeport Brass Co., Bridgeport, Conn. Booth D-411.
Charles Bruning Co., Inc., Chicago. Booth A-411.
Brush Development Co., Cleveland. Booth B-142.
Buckeye Garment Rental Co., Cleveland. Booth B-419.
Adolph I. Buehler, Chicago. Booth E-111.
H. W. Butterworth & Sons, Bethayres, Pa. Booth B-320.
Canadian Radium & Uranium Corp., New York. Booth S-130.
Carboloy Co., Inc., Detroit. Booth B-324.
Carborundum Co., Niagara Falls, N. Y. Booth C-122.
Catskill Metal Works, Inc., Catskill. N. Y. Booth A-514.
Chase Brass & Copper Co., Waterbury, Conn. Booth B-327.
Chicago Flexible Shaft Co., Stewart Industrial Furnace Div., Chicago. Booth E-114.
Chicago Steel Foundry Co., Chicago. Booth L-102.
Chilton Publishing Co. Booth B-121.
Cleveland Graphite Bronze Co., Cleveland. Booth C-322.
Cleveland Tapping Machine Co., Cleveland. Booth A-309.
Climax Molybdenum Co., New York. Booth A-501.
Commerce Pattern Fdry. & Machine Co., Detroit. Booth B-424.
Continental Industrial Engineers, Inc., Chicago. Booth C-133.
R. W. Cramer Company, Inc., Centerbrook, Conn. Booth C-424.
Crown Rheostat & Supply Co., Chicago. Booth A-310.
Darwin & Milner, Inc., Cleveland. Booth C-118.
Deepfreeze Div. of Motor Products Corp., North Chicago, Ill. Booth A-401.
Delaware Tool Steel Corp., Wilmington, Del. Booth A-325.
A. P. de Sanno & Son. Inc., Phoenixville, Pa. Booth B-431.
Despatch Oven Co., Minneapolis, Minn. Booth A-415.
Detroit Rex Products Co., Detroit. Booth D-311.
Harry W. Dietert Co., Detroit. Booth A-410.
DoAll Cleveland Co., Inc., Cleveland. Booth B-141.
Dow Chemical Co., Midland, Mich. Booth B-111.
E. I. duPont de Nemours & Co., Wilmington, Del. Booth D-134.
Duraloy Company, Scottdale, Pa. Booth B-110.
Eastman Kodak Co., Rochester, N. Y. Booth A-318.
Eisler Engineering Co., Newark, N. J. Booth A-500.
El Taller Mecanico Moderno. Booth C-431.
Elastic Stop Nut Corp., Union, N. J. Booth A-424.
Electro Refractories & Alloys, Buffalo, N. Y. Booth D-315.
Electroloy Co., Inc., Bridgeport, Conn. Booth A-500.
Eutectic Welding Alloys Co., New York. Booth E-140.
Expert Welder Co., Detroit. Booth A-500.
Farrel - Birmingham Co., Ansonia, Conn. Booth B-320.
Federal Machine & Welder Co., Warren, Ohio. Booth A-500.
Federal Products Corp., Providence, R. I. Booth B-401.
Firth-Sterling Steel Co., McKeesport, Pa. Booth C-150.
Florence Pipe Fdry. & Machine Co., Philadelphia. Booth B-320.
J. B. Ford Co., Wyandotte, Mich. Booth C-117.
Fulton Foundry & Machine Co., Cleveland. Booth B-320.
Gardner Publications, Inc., Cincinnati. Booth C-431.
General Alloys Co., Boston. Booth C-146.
General Electric X-Ray Corp., Chicago. Booth E-130.
General Fdry. & Mfg. Co., Flint, Mich. Booth B-320.
Globar Division of Carborundum Co., Niagara Falls, N. Y. Booth C-122.
Globe Machine & Stamping Co., Cleveland. Booth B-335.
Claud S. Gordon Co. of Ohio, Cleveland. Booth E-102.
Gray Machine Co., Philadelphia. Booth S-124.
Gray-Mills Co., Chicago. Booth B-418.
Great Lakes Steel Corp., Ecorse, Mich. Booth S-150.
Greenlee Foundry Co., Chicago. Booth B-320.
Gulf Oil Corp., Gulf Refining Company, Pittsburgh. Booth A-329.
H & H Research Co., Detroit. Booth C-242.
Hamilton Fdry. & Machine Co., Hamilton, Ohio. Booth B-320.
Hammond Machinery Builders, Inc., Kalamazoo, Mich. Booth D-122.
Handy & Harman, New York. Booth D-314.
Heat Treating and Forging, Pittsburgh. Booth B-514.
Heil & Co., Cleveland. Booth A-332.
Hevi Duty Electric Co., Milwaukee. Booth D-142.
Hild Floor Machine Co., Chicago. Booth C-324.
Hitchcock Publishing Co., Chicago. Booth A-314.
A. F. Holden Co., New Haven, Conn. Booth B-147.
W. J. Holliday & Co., Hammond, Ind. Booth C-315.
E. F. Houghton & Co., Philadelphia. Booth D-137.
Edward Howard & Co., Cleveland. Booth C-322.
Illinois Testing Laboratories, Inc., Chicago. Booth E-133.
Independent Pneumatic Tool Co., Chicago. Booth C-314.
Industrial Heating. Booth D-325.
Industrial Press. Booth E-122.
Industrial Publishing Co. Booth A-416.
Industry and Welding, Cleveland. Booth A-416.
Instrument Specialties Co., Inc., Little Falls, N. J. Booth C-335.
International Nickel Company, Inc., New York. Booth C-111.
The Iron Age, New York. Booth B-121.
C. Walker Jones Co., Philadelphia. Booth B-524.
Kanawha Mfg. Co., Charleston, West Va. Booth B-320.
J. W. Kelley Co., Cleveland. Booth C-336.
Kelley-Koett Mfg. Co., Inc., Covington, Ky. Booth E-114.
Andrew King, Narbeth, Pa. Booth B-118.
Kinney Iron Work, Los Angeles, Calif. Booth B-320.
Koehring Co., Milwaukee, Wis. Booth B-320.
Kold-Hold Mfg. Co., Lansing, Mich. Booth E-130.
Krouse Testing Machine Co., Columbus, Ohio. Booth C-420.
Lepel High Frequency Laboratories, New York. Booth D-328.
Lester Engineering Co. Booth A-341.
Lester-Phoenix, Inc., Cleveland. Booth A-341.
Lindberg Engineering Co., Chicago. Booth B-146.
Lukens Steel Co., Coatesville, Pa. Booth C-340.
Machine Tool Blue Book. Booth A-314.

(CONTINUED ON PAGE 234)